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Oat Production in Texas

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Department of Agronomy

In cooperation with the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

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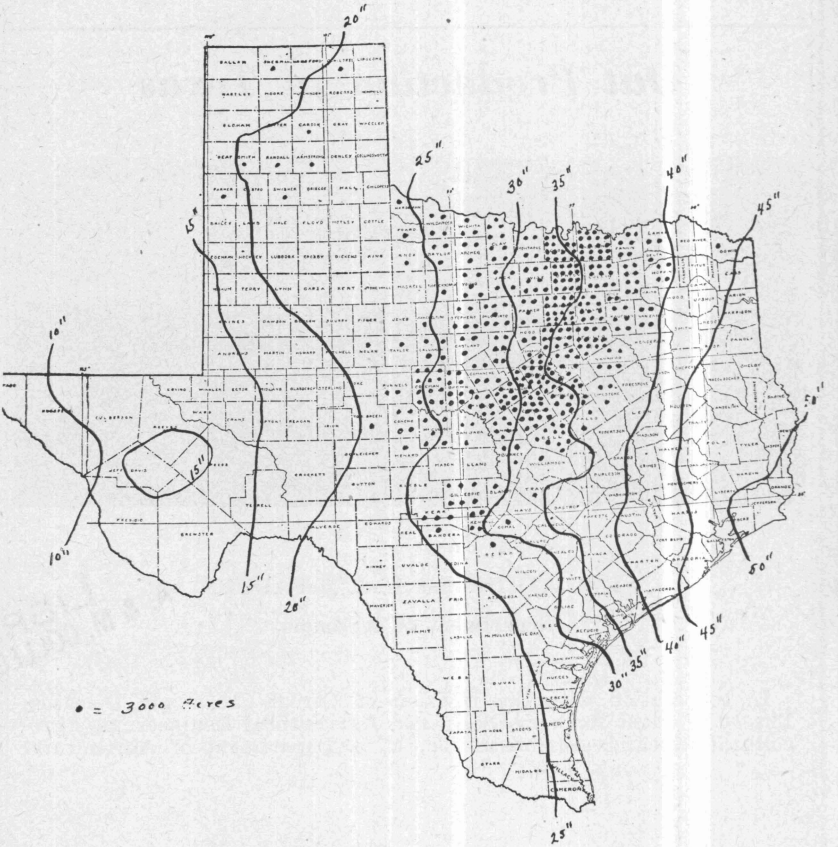

Figure 2. Rainfall belts and distribution of oat acreages in Texas in 1939.

Preface

Oats rank fifth in acreage among the farm crops of Texas. The crop is best adapted to the heavy soils of the Central Texas Blackland area but is also grown extensively in the lighter soils of the Rolling Plains area. The majority of the crop is fall-sown in these areas, because fall-sown oats produce average yields of 10 to 15 bushels per acre more than spring-sown oats. Extensive winterkilling of oats has occurred in the State in 6 of the last 35 years and serious injury or differential killing of varieties occurred in 5 additional seasons. When the fall-sown crop is winterkilled, it is often replanted in January.

In Central Texas oats are equal or superior to other grain crops in yield of pounds of grain or total feeding value per acre and they are favored as a feed for breeding stock. Oat straw is more valuable than other cereal straws. In the fall-sown oat area, oats are the favored cereal for fall and winter grazing, or for forage production. Oats fit conveniently into the rotation and crop sequences of Central Texas with either cotton or corn as the previous crop.

The most extensively grown and widely adapted varieties are the Red Rustproof strains such as New Nortex and Ferguson 922. They are adapted to all the growing areas except extreme South Texas. Fultex is early maturing, resistant to crown (leaf) rust, resistant to lodging, and adapted to a wide area. Ranger, Rustler, Alber, Camellia and Verde are adapted to South Texas because of their resistance to crown rust. Wintok, Tennex and Fulwin are very hardy varieties adapted to Northwest Texas.

The most serious oat diseases are crown rust and stem rust. The growing of resistant varieties is the only practical method of control. Helminthosporium blight is a serious new disease which can be partly controlled by seed treatment and rotation, or by the growing of resistant varieties. Smut can be controlled by seed treatment.

Shown on the front cover is Figure 1, a field of New Nortex oats cut with a binder and curing in shocks in preparation for threshing.

CONTENTS

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Agronomists, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, in cooperation with workers at substations of the Texas Agricultural Experiment Station.

The acreage devoted to oats in Texas ranks fifth among the farm crops grown, being exceeded by cotton, corn, wheat and grain sorghum in the order named for the 10-year period, 1934-43, inclusive. In the Central Texas Blacklands, oats have ranked second only to cotton in acreage and value of the crop until recently. During the war years the acreage of grain sorghum and of corn have surpassed oats. Because of sparse precipitation during the spring months in the western part of the State, oats are grown extensively only in favorable seasons, the acreage and production varying widely from year to year. Until rust-resistant varieties were developed, the production of oats for grain in South Texas was impractical and their use as a pasture crop was limited by serious attacks by the oat rusts each season. With the development of rust-resistant varieties, oat acreage in that area has greatly expanded in recent years and further use may be made of the crop as further improved varieties become available.

During the 10-year period, 1934-43, inclusive, the average harvested acreage of oats in Texas was 1,412,000 acres, with an average production of 33,425,000 bushels, or an average yield of 23.7 bushels per acre. The largest acreage ever grown, 1,932,000 acres, was harvested in 1921; while the greatest production of 65,209,000 bushels was harvested in 1919. The distribution of the oat acreage by counties in Texas for the 1939 crop as given in the 1940 census is shown in Figure 2, together with lines showing the average annual precipitation belts.

Adaptation of Oats

Oats are grown under a wide range of soil and climatic conditions in Texas. They are adapted to nearly all the so-called "tight" soils of the State; and, though less productive, are also grown to a considerable extent on the lighter soils. With the development of rust-resistant varieties, oats may be successfully grown for pasture

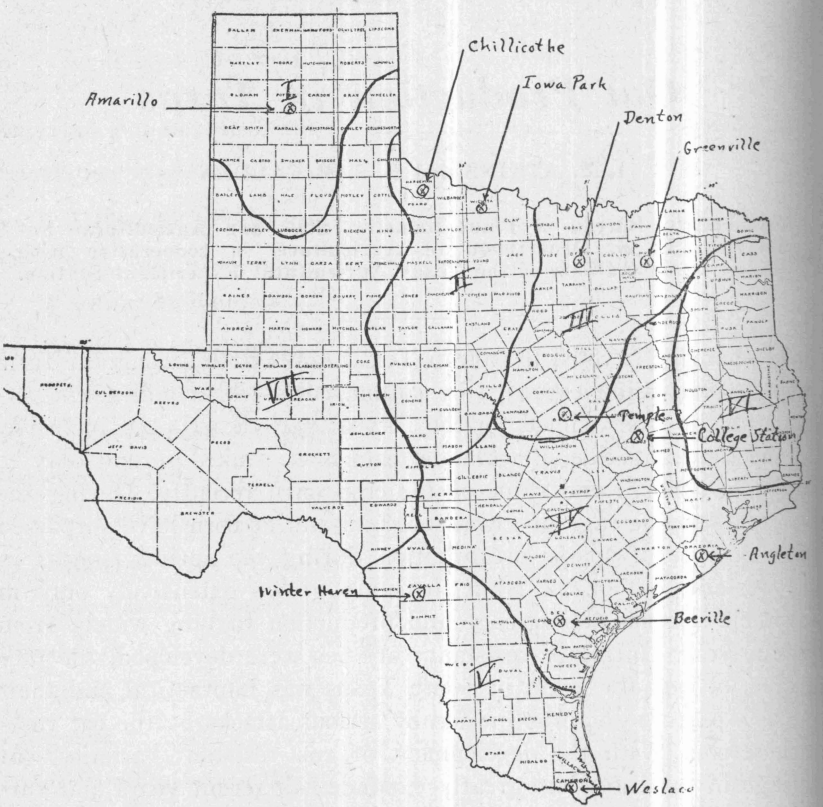


Figure 3. Oat-growing regions of Texas with locations of stations at which oat experiments are conducted.

and feed along the Gulf coast where precipitation often amounts to as much as 50 inches per year. Also, in favorable spring seasons they may be successfully grown in West Texas where the average annual precipitation is less than 20 inches.

In order to be able to more accurately designate the areas under discussion in this bulletin, the State has been arbitrarly divided into seven major subdivisions in Figure 3, representing seven major climatic conditions varying in their suitability and adaptation to the growing of oats. In most instances the lines of demarcation between areas is not sharp, one area blending into the adjoining area. The locations of the several experiment stations cooperating in the oat investigations herein reported are also shown.

A very brief description of the areas and their suitability for oat growing follows:

1. *Panhandle-Plains area*—precipitation 18-22 inches; eleva-

tion 3,000-4,000 feet; spring-sown oats grown extensively in years of favorable spring rainfall; fall-sown oats hazardous because of winter-killed.

2. *Rolling Plains area*—precipitation 24-28 inches; elevation 750-2,000 feet; more than half the area has sandy soils not well adapted to small grains; majority of oats fall-sown but subject to winter-killing; spring-sown acreage smaller, except when fall-sown oats are winter-killed.

3. *Blackland and Grand Prairie areas*—precipitation 30-40 inches; elevation 500-750 feet; majority of oats fall-sown, subject to winter-killing occasionally; spring-sown acreage smaller, except when fall-sown oats are winter-killed.

4. *Gulf Coast area*—precipitation, 25-45 inches; elevation 50-500 feet; only fall-sown oats grown, much of the acreage for grazing purposes only; crop subject to serious damage by rust.

5. *Lower Rio Grande Valley and Winter Garden areas*—precipitation 20-30 inches; elevation 50-500 feet; considerable areas under irrigation; majority of acreage used for grazing purposes only; crop subject to serious rust damage.

6. *East Texas Timber area*—precipitation 40-50 inches; only limited acreage grown, requires high applications of fertilizers for growing of oats on sandy-loam soils.

7. *West Texas ranching area*—small acreages planted for winter pasture, usually too dry for grain production.

The most extensive acreages of oats are grown in the Central Texas Blackland area from Bell County northward to the Oklahoma state line, with the largest acreages in Tarrant, Denton and Grayson Counties. A second area of intensive cultivation of oats is in Bosque, Hamilton and Coryell counties. In this area (Region 3) the majority of the crop is fall-sown, except in seasons when winterkilling occurs when a majority may be spring-sown. Farther south in the State, fall seeding is universal; while to the west of Central Texas an increasingly larger proportion of the crop is spring-sown.

In order to show the comparative productiveness of oats with other feed crops at various locations in the State, the average production of these crops in bushels per acre, pounds per acre, and in productive energy per acre are given in Table 1 for several experiment stations. In the final analysis, the value of a crop is not dependent entirely upon the number of pounds or bushels per acre it produces but upon the amount of productive energy it makes available to livestock from this feed. The productive energy,

Table 1. Comparative production of five farm crops in bushels, pounds and productive energy per acre at experiment stations in Texas

	Grain sorghum	Corn	Barley	Oats	Wheat
Productive energy of each feed-therms per 100 lbs	84.8	84.8	74.4	70.5	78.8
Texas Substation No. 6, Denton, Texas					
Average yield, 14 years, 1929-1943, bushels	33.4	29.2	36.5	73.8	27.5
Average yield, 14 years, 1929-1943, pounds	1870	1635	1752	2362	1650
Productive energy per acre-therms	1586	1386	1303	1665	1300
Texas Substation No. 5, Temple, Texas					
Average yield, 6 years, 1938-1943, bushels	18.2	37.1	23.8	47.6	18.6
Average yield, 6 years, 1938-1943, pounds	1019	2078	1142	1523	1116
Productive energy per acre-therms	864	1762	850	1074	879
U. S. Cotton Field Station, Greenville, Texas					
Average yield, 6 years, 1938-1943, bushels	28.1	19.6	26.9	42.9	20.7
Average yield, 6 years, 1938-1943, pounds	1574	1098	1291	1373	1242
Productive energy per acre-therms	1335	931	961	968	979
Texas Substation No. 16, Iowa Park, Texas					
Average yield, 9 years, 1932-1943, bushels	25.0	8.4	35.7	68.2	26.1
Average yield, 9 years, 1932-1943, pounds	1400	470	1714	2182	1566
Productive energy per acre-therms	1187	399	1275	1538	1234
Texas Substation No. 12, Chillicothe, Texas					
Average yield, 5 years, 1938-1943, bushels	21.2	15.8*	27.5	30.9*	22.0
Average yield, 5 years, 1938-1943, pounds	1187	885	1320	989	1320
Productive energy per acre-therms	1007	783	982	697	1040

*10-year average yield of fall sown oats at U. S. Dry Land Field Station, Lawton, Oklahoma.

on an acre basis, was computed by multiplying the yield in pounds per acre by the value of this grain in terms of productive energy per 100 pounds as reported in Texas Agricultural Experiment Station Bulletin No. 461, "The Composition and Utilization of Texas Feeding Stuffs."

In the more intensive oat-growing area, Region 3 of Central Texas, represented by the experiment stations at Denton and Greenville on the north and by the station at Temple on the south, oats rank either first or second in pounds of feed and productive energy produced per acre. At Denton, oats produced more pounds of feed per acre than any other crop. At Greenville, grain sorghum leads oats slightly in productive energy per acre; while at Temple, corn is slightly more productive than oats. In the Rolling Plains area, grain sorghum is the major feed crop, with oats a close second. At Chillicothe, which is representative of this area, oats have been under test only a short time, but at the U. S. Dry Land Field Station, Lawton, Okla., which is located just north of Chillicothe in a similar soil and climatic area, Red Rustproof oats averaged 30.9 bushels per acre for the 10-year period 1931-40, inclusive. This average yield is used for comparison with other crops for the Chillicothe area and indicates that oats are less productive than the other feed

crops for this area. At the Iowa Park station, where all crops are irrigated, oats produced more feed per acre than any other crop. No adequate comparisons can be made in South Texas.

Uses of the Oat Crop

Nearly all oats grown in Texas are utilized as feed for livestock within the State. Only in seasons of very high production or of crop failures in nearby states, are oats shipped out of the State extensively. The vast areas of the State devoted to ranching, where climate or soils are not suitable for the growth of sufficient feed crops to maintain the livestock through the winter, provide a good market for any surplus oats produced in other areas. Oats have long been known as a desirable feed for breeding stock of all kinds. The analyses of oats and several other feed grains in Texas, as reported in Texas Agricultural Experiment Station Bulletin No. 461, "The Composition and Utilization of Texas Feeding Stuffs," is given in Table 2. From this table it will be seen that oats do not compete with corn, barley or grain sorghum in the fattening ration, but are unsurpassed as a balanced food for growing stock or the breeding herd.

The very high value of small grains as a source of winter pasture in Texas has only recently been fully recognized. The possibilities of further extending the periods of grazing through the use of varieties especially adapted to grazing at particular periods has not been adequately explored. Oats are a favorite crop for winter pasture because they produce high yields of a succulent, palatable, high protein food. Controlled grazing is also beneficial during many seasons because it reduces the succulent top growth, thereby reducing the chances of winter-killing. Comparative tests of the value of wheat, oats, barley and rye grass for winter pasture were made at the Lubbock, Denton and Angleton stations in the 1932, 1933 and 1934 seasons. The results are published in Texas Agricultural Experiment Station Bulletin No. 539, "Small Grain

Table 2. Analysis of some Texas grown feeds

Crop	No. of tests	Percent protein	Ether extract	Crude fiber	Nitrogen-free extract	Water	Ash	Digestable protein	Productive energy per 100 lbs.
Corn	105	10.4	4.4	2.3	72.5	9.1	1.3	6.4	84.8
Barley	336	12.0	2.1	6.3	67.5	9.3	2.8	9.6	74.4
Milo	652	11.1	2.9	2.5	70.9	10.7	1.9	8.1	84.8
Red Oats	469	11.4	4.9	12.8	58.6	8.6	3.7	8.9	70.5
Wheat	14	14.0	1.7	3.0	69.4	10.0	1.9	11.3	78.8

and Rye Grass for Winter Pasture." It was found that oats and barley grew more rapidly in the fall, thus producing the quickest fall grazing and the greatest tonnage of forage. Wheat and rye made slower fall growth but were better suited to winter and late spring grazing. The grain yield of oats and barley was injured more by late spring grazing than was that of rye or wheat.

Recent studies of the pasture and forage value of new rust-resistant oat varieties made at Beeville, Winter Haven and Weslaco, show that in South Texas the varying growth habits of the spring-type and winter-type oat varieties may be utilized to good advantage to give prolonged periods of grazing or high yields of forage. These studies are reported in Texas Agricultural Experiment Station Progress Reports No. 903 and 950. At Beeville, Ranger oats planted September 22, 1943, furnished a long period of grazing during the winter, producing 2.3 tons of dry matter per acre. Under field conditions, 35 acres of Rustler oats produced a total of 64 unit days of grazing per acre from December 18 to February 19, having a total value of $8.75 per acre. Tests at Winter Haven during the 1944 and 1945 seasons showed that fall-sown, rust-resistant, spring-type varieties, such as Vicland and Boone, are of special value for fall and early winter grazing. These spring-type varieties, owing to their rapid early growth, furnish abundant early fall pasture while later maturing varieties, such as DeSoto, Florilee, Ranger and the Red Rustproof strains, may be used to produce later grazing. Combination plantings of the two types may further supplement the temporary pasture for that area.

Oats alone, or in mixtures with sweet clover or other legumes, make valuable hay. Oat straw is superior to wheat or barley straw as a roughage for livestock. Oats may be used either as a green manure crop or as a cover crop to protect the land from erosion during the winter months. In recent years, oats have been used extensively as a companion crop for sweet clover, especially the biennial varieties.

Culture of Oats

The cultural operations for oats are similar to those required for other small grains and are familiar to most farmers, therefore, only a few suggestions regarding culture will be made. The best yields are obtained when well-adapted varieties are used and the crop is grown on fertile, well-drained soil, following good seedbed preparation.

Place in The Rotation

Oats may follow nearly any crop in the more intensive oat-growing areas of Central Texas, although the most common sequence is for oats to follow corn or cotton. Corn usually matures sufficiently early to allow a good seedbed to be prepared for fall-sown oats. Cotton land provides an inexpensive, almost ideal seedbed for grain. Occasionally when cotton picking is delayed, seeding of the fall oat crop must be delayed beyond the optimum time. Volunteer grain and annual weed grasses such as false wild oats and cheat often give trouble if oats follow other small grains in the rotation. If such a sequence is necessary, this difficulty may be overcome by delaying planting until spring. Oats should not follow sorghum crops in Central Texas. The residue of a sorghum crop decays slowly during the winter months. Any crop planted on this land during this time will suffer from lack of available nitrogen. This is a temporary effect which is especially apparent in the growth of fall-sown grain crops. Spring-planted crops such as cotton or summer legumes may be used with less reduction in yield providing the residues are turned under early in the fall. This deleterious effect of sorghum is much less important in the western part of the State.

A combination of spring-sown oats and Madrid biennial sweetclover has been found to be a desirable sequence in 3-year and 4-

Figure 4. Sweet clover growing alone and in combination with spring-sown oats as a companion crop at Denton, Texas.

year rotations at the Denton station. In such rotations oats are seeded in January or early February, then overseeded immediately with sweet clover. Planting of the sweet clover should be a separate operation since it requires shallower planting than the oats. The planting may be made in 3-foot rows, 18-inch rows or drilled in the usual manner. Where the clover is planted in 3-foot rows it may be cultivated after oat harvest to kill weeds. After the oats are harvested for grain, the clover may produce considerable hay or pasture the first season and either hay or a seed crop or combination of the two the second year. Hubam, the annual sweet clover, has been used successfully as a fall-sown crop in combination with fall-sown oats in the southern half of Region 3 and in Region 4 in recent years. In Figure 4 is shown the first year's growth of Madrid sweet clover when planted alone and in combination with spring-sown oats as a companion crop.

Oats are grown extensively in Region 1 of West Texas only in seasons when spring moisture conditions are favorable. With the development of more hardy strains now in prospect, it may be possible to seed larger acreages in the fall. Under such conditions, more attention will need to be given to good seedbed preparation and crop squence.

Seedbed Preparation

Seedbeds for oats following corn are usually prepared by shallow plowing with the one-way plow, followed by harrowing or such other preparations as are necessary to prepare a good, firm seedbed. For oats which follow cotton, the land is usually not plowed but is worked down to a level seedbed with a disc-harrow, spring-tooth harrow, spike-tooth harrow, or spring-tooth field cultivator. As cotton land is usually free of weeds, the only preparation necessary is to level the ground to permit uniform drilling. A good seedbed in cotton-stalk land made by cultivating with a spring-tooth field cultivator followed by a spike-tooth harrow is shown in Figure 5, while in Figure 6, oats are being drilled on this same seedbed. The cotton stalks are cut early in the spring.

Because of the danger of soil blowing, seedbeds intended for spring-sown oats in Region 1 of West Texas should be left as rough as possible through the winter months. This will also aid in retaining snow or other winter moisture. The seedbed may be worked down just previous to planting. Fallow provides a favorable seedbed for oats, but, owning to the low cash value of the crop compared with wheat, oats are seldom planted on fallow. Where oats follow grain sorghum, the sorghum stubble should be plowed sufficiently

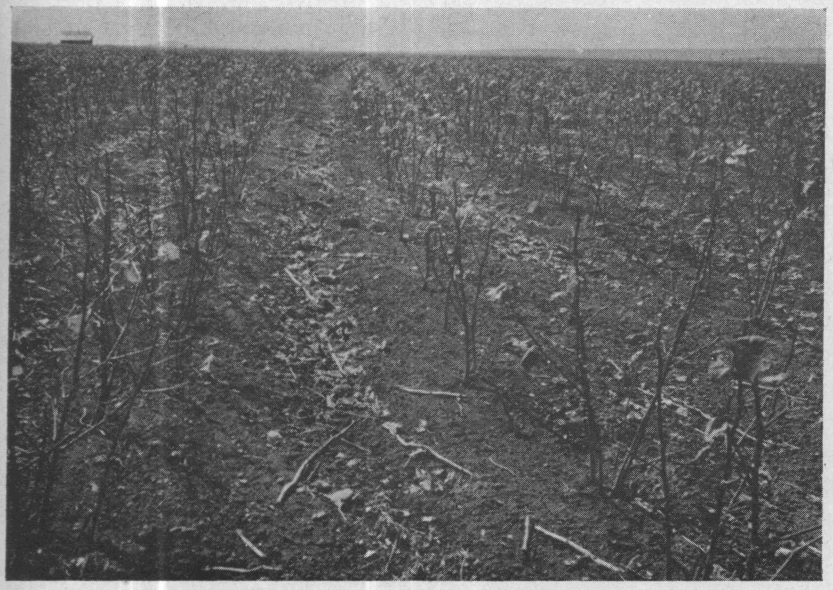


Figure 5. Seedbed for oats prepared in cotton stalks by a spring-tooth cultivator followed by a harrow.

Figure 6. Drilling fall-sown oats in a seedbed prepared in cotton stalks. The cotton stalks provide some protection during the winter and are cut before spring growth starts.

early to permit weathering and the preparation of a good seedbed. Seedbeds for fall-sown oats in this region should be prepared as carefully as those for wheat.

Rate and Date of Seeding

Oats should be drilled rather than broadcast in order to insure a uniform rate and depth of seeding. The rate and date of seeding varies considerably within any region depending upon weather conditions and the needs of the individual grower. Approximate optimum dates and rates of seeding, based on experiments and prevailing farm practices, are given below. Earlier seedings are often justified if fall pasture is needed. Late fall seedings and spring seedings should usually be planted at higher rates than normal-date fall seedings. The rate of seeding should be higher on less fertile soils than on fertile soils since the plants tiller less.

	Optimum planting date		Optimum planting rate	
	Spring	Fall	Spring	Fall
Region 1	Mar. 1	Sept. 15	56 lbs.	48 lbs.
Region 2	Feb. 1	Oct. 1	72	64
Region 3	Jan. 15	Oct. 15	96	72
Region 4	*	Oct. 15		72
Region 5	*	Nov. 15		72
Region 6	Very few	oats grown		
Region 7	Very few	oats grown		

*Not recommended

Harvesting and Threshing

Until recently, practically all oats in Central Texas were harvested with a binder and threshed with the usual custom thresher. This method, though more expensive than direct combine harvesting, has several advantages in this area. May, when most fall-sown oats are harvested, has the highest average precipitation of any month, which often results in unfavorable conditions for combining. By using a binder, the crop can be harvested before it is dead ripe while the crop is standing erect and the grain still contains considerable moisture. The grain may then be threshed at a later date when conditions are more favorable. This usually results in better quality grain and the straw may be saved for feed or bedding. The disadvantages of this method include higher cost of harvesting, later tillage of the land and longer exposure of the crop

to weather conditions during extended periods unfavorable to threshing. A field of New Nortex oats in the shock ready for threshing is shown in Figure 1, on the front cover.

Combine harvesting of oats and other small grain has been common in the Texas Panhandle (Region 1) for many years, and has been common in the Rolling Plains area (Region 2) for a somewhat shorter period. With the introduction of the small combine harvester-thresher suitable for the average farm of Central Texas, this method of harvesting has rapidly increased in this area. Oats are not as well adapted to direct combine harvesting as other small grains because the straw is weak and the crop breaks over soon after maturity. When extended periods of wet weather occur near harvest time, serious losses from shattering and lodging may result. The use of erect, stiff-strawed varieties such as Fultex and Victorgrain is of distinct advantage under many conditions, but, if these varieties are forced to stand in the field for prolonged periods, serious shattering losses may result. In the Rolling Plains area where weather conditions are more favorable at harvest time, these varieties have proved well adapted. Even though varieties break over, they can usually be harvested with a small combine, although the cost of harvesting is increased because of the necessity of cutting

Figure 7. Direct combine-harvesting of severely broken-down or lodged oats. Under such conditions the cost of harvesting is increased but most grain can be recovered. Some loss from shattering and cutting off of heads occurs.

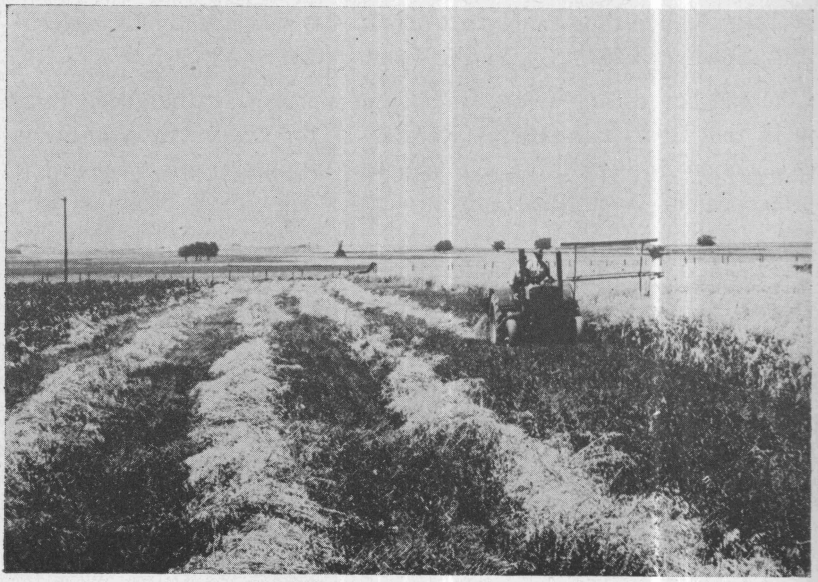


Figure 8. Windrowing of oats with an ordinary binder from which the tying mechanism has been removed.

Figure 9. Threshing oats from the windrow, using a small combine with a pick-up attachment.

very low and running all the straw through the machine. When such severe cases of lodging occur, some grain is cut off by the sickle and lost and some shattering occurs. A field of oats which has broken over but is being harvested with only moderate loss of grain is shown in Figure 7.

Another method of harvesting, which has been found practicable by some growers, is that of windrowing or swathing the crop, then threshing a few days later with a combine having a pick-up attachment. This method is especially suitable on land infested with Johnson grass or other weeds. As with the binder and custom thresher, this increases the cost of harvesting. The windrowing or swathing can be done with regular machinery made for this purpose, or, if that is not available, it can be done with an ordinary binder by removing the tying mechanism. The oats will pass through the binder and out in a continuous swath which can then be threshed with the combine using a pick-up attachment. Caution should be exercised that the swath is small enough to be handled by the combine used. For example, a 5-foot combine often cannot handle the rank grain cut by an 8-foot binder, therefore, the width of grain cut should be adjusted as necessary. Oats in the swath may be seriously damaged during extended periods of wet weather. Windrowing of oats with an ordinary binder is shown in Figure 8, while in Figure 9 the grain in this same field is being threshed with a combine using a pick-up attachment.

When harvesting with a combine, great care is necessary to see that the grain is fully ripe and of low moisture content. Oats with high moisture content heat rapidly if stored in large quantities in tight bins. Viability of the seed may be reduced greatly if oats heat in storage. If oats of high moisture content must be stored, they should be stored in small piles and stirred frequently for several days or some provision made for artificial drying. The placing of burlap sacks filled with straw at intervals throughout the bin to provide ventilation and absorb moisture is suggested as an aid in drying out grain of high moisture content.

Varieties of Oats

Most oat varieties grown commercially in Texas at present belong to the red oat group (*Avena byzantina*). They are divided into three types: the early maturing Fulghum type, the midseason Red Rustproof type, and the late maturing Fulghum (winter type). By far the largest acreage is seeded to the Red Rustproof type oats. The varieties of yellow or white common oats (*Avena sativa*),

grown in the major oat-producing states of the Corn Belt, are poorly adapted to Texas conditions because they are not sufficiently hardy to survive when fall-sown in most of the State and, when spring-sown, encounter hot weather at maturity. Some of the recently developed disease-resistant varieties of this type may be valuable as supplementary pasture crops in extreme South Texas. Some promising white kernel strains have recently been developed in Texas from crosses of adapted varieties and disease-resistant common oats, but none is yet available commercially.

The winter-hardy varieties, Hairy Culberson, Curtis, Lee, Winter Turf, Wintok and the Fulghum (winter type) strains Fulwin, Tennex and Forkedeer are so highly susceptible to crown (leaf) rust and stem rust that they cannot be generally recommended in Texas. Recently developed rust-resistant strains selected from crosses on these hardy varieties give promise of hardy disease-resistant varieties in the near future. Brief descriptive notes of the more important commercial types and varieties follow.

Red Rustproof Types

The original Red Rustproof oats were introduced into the United States from the Mediterranean region of northern Africa many years ago, but the recorded history is inadequate. The best information available indicates that Red Rustproof oats were brought to Texas about 1875. Because they were more rust-resistant and better adapted than the Winter Turf oats, and more heat tolerant than the common white oats then grown in Texas, they found immediate favor. They soon became the dominant variety and have continued in that place to the present. They became known as Texas Red Rustproof oats because large quantities were shipped from Texas to the Southeastern States to supply seed needs of farmers of that area who grew them for feed. In that area, the oats were fed in the sheaf as no threshing facilities were available and the farmers depended on buying new seed from Texas each year. Sherman, Texas, became the center of this seed business which thrived for many years.*

Red Rustproof oats have been grown in Texas under many strain names, among the better known being Texas Red, Bancroft, Appler Rustproof, McReynolds Rustproof, and in more recent years under the named improved strains Nortex, New Nortex, Ferguson 71 and Ferguson 922. Additional localized names have been given strains

*Taken from the 1904 Texas Almanac published by the A. H. Belo Corporation, Dallas, Texas.

selected in other states, among the more recent being Delta Red in Mississippi. All these strains are similar in most plant and grain characteristics and, in most instances, originated as either mass or pure-line selections. Although moderately tolerant to crown rust, the name Red Rustproof is misleading since serious losses occur during rust epidemics. Owing to the tolerance or "late rusting" characteristic of Red Rustproof oats, they are usually injured less than most susceptible varieties.

Nortex and New Nortex: These strains were developed in the small grain breeding program at the Denton station. Both originated as pure-line selections from Red Rustproof type oats. Nortex was selected from a lot of Texas Red Rustproof oats purchased from a farmer near Krum, Texas, in 1914. More than 1,000 head selections were made from this and other lots of seed. After extensive testing from 1921 to 1926, Nortex was distributed to farmers in 1926. As compared with the original lot of seed from which it was selected, Nortex is more uniform in plant characters, more productive, and from spring seeding is often earlier in maturity. New Nortex was selected in 1919 from Appler Rustproof oats that had been obtained from a farmer near Krum, Texas, in 1914. The original Appler Rustproof oats originated in Georgia many years ago on the farm of a Mr. Appler for whom the strain was named. New Nortex is slightly more winter-hardy than Nortex, often taller, and from spring seeding is often later in maturity. The grain of the two strains is indistinguishable, being typical of Red Rustproof with long, slender kernels of light red color with a large proportion of husk and moderately heavy, non-twisted awns on both kernels of the spikelet. Tests subsequent to the distribution of Nortex, proved that New Nortex was consistently higher yielding, therefore, it was distributed to farmers in 1936. Distribution of Nortex has been discontinued. Acreages of the two varieties constitute the majority of oats in Central Texas as few other varieties were distributed in the State until recent years. They are probably the most extensively grown varieties of Red Rustproof oats as, in addition to the Texas acreage, large acreages are grown in Oklahoma, Arkansas, Mississippi and Alabama.

Ferguson No. 71 and No. 922: These strains, the former distributed from 1916 to 1926 and the latter from 1926 to the present time, were developed as pure-line selections from Texas Red Rustproof oats by the A. M. Ferguson Seed Farms, Howe, Texas, formerly of Sherman, Texas. According to A. M. Ferguson:

> "Ours was the first effort to ever attempt to develop a pedigree selection of the thousands of forms of what was called the Texas

Red oat. During some 20 years, we made over ten thousand stooled selections and possibly planted as many rows in head to row tests. This work began about the turn of the century. After about 9 years' testing we selected No. 371 for propagation and it was introduced in 1916 as Ferguson 71 oats."

Both Ferguson No. 71 and No. 922 are typical Red Rustproof oats of superior yielding ability and were important advances in uniformity and yield over the mixed stocks then grown commercially. Ferguson No. 71 oats were once extensively grown in Texas and their successor, Ferguson No. 922 oats, now occupies considerable acreages in Texas, Arkansas and other Southern States.

Ranger and Rustler: These two varieties are sister selections from a cross of Nortex with Victoria, a crown (leaf) rust and smut-resistant red oat introduced from South America. These varieties were developed cooperatively by the Texas Agricultural Experiment Station and the U. S. Department of Agriculture. The cross was made at Arlington Farm, Va., in 1930, and bulk hybrid seed sent to a number of southern agricultural experiment stations. Many selections were tested at all substations in Southern Texas, and 2 superior strains were named and distributed to farmers in 1941. Ranger and Rustler are similar to Nortex in many plant and grain characters but are resistant to crown (leaf) rust and to smut. Rustler is shorter in stature than Ranger and earlier in maturity under most conditions. Both varieties are superior to Nortex in test weight, but both are less winter-hardy, hence they cannot be recommended for fall seeding in the northern part of the State. In Region 4, they produced yields much superior to the older Red Rustproof strains until 1945 when they were seriously damaged by the new Helminthosporium blight disease. Because of their resistance to crown rust, they have been of special value for winter grazing in South Texas. Both varieties are highly susceptible to stem rust.

Verde: This variety was distributed to fill a special need in South Texas for a variety suitable for grazing and for clipping to produce dehydrated cereal forage for livestock and poultry feed. Verde was developed cooperatively by the Texas Agricultural Experiment Station and the U. S. Department of Agriculture from a cross of Texas Red Rustproof and Selection 5542-1 of Victoria-Richland, the first generation of which was backcrossed to Texas Red Rustproof. Verde is similar to Red Rustproof in many plant characters but has more slender grain and is resistant to crown (leaf) rust, to smut and to some races of stem rust. It is adapted to only a small area in extreme South Texas because of its lack of cold resistance.

Alber: This variety was introduced from South America by the U. S. Department of Agriculture and, after testing, was distributed in Louisiana by the Louisiana Agricultural Experiment Station. It is classed as a Red Rustproof type oat but differs in several characteristics, among which are lack of cold resistance and moderate resistance to crown (leaf) rust. It is adapted to fall-seeding only in Regions 4 and 5.

Camellia: This variety was developed cooperatively by the Louisiana Agricultural Experiment Station and the U. S. Department of Agriculture. It was selected from a cross of Bond, a variety of red oats introduced from Australia, and Alber, described above. Camellia has large, plump, red kernels; erect, vigorous early plant growth; and is highly resistant to nearly all the races of crown (leaf) rust and to Helminthosporium blight, but, it is highly susceptible to stem rust. Because of its lack of winter-hardiness, it should not be fall-seeded except in Regions 4 and 5 of South Texas.

Fulghum Types

The original Fulghum oat was selected from Red Rustproof by J. A. Fulghum, a farmer of Warrenton, Georgia. This occurred before 1900. It was increased by Mr. Fulghum and seed sold to neighbors. It is not known when it was brought to Texas, but it has been grown here many years. At one time the area devoted to Fulghum oats was rather extensive. Fulghum oats have been grown under the trade and strain names of Fulghum, Early Red Rustproof, Nicholson Improved Extra Early, Coker Fulghum, Frazier and Kanota. In general, the Fulghum strains differ from the Red Rustproof strains in being from 10 to 14 days earlier in maturity and in producing grain with fewer awns and higher test weight. All strains of Fulghum are highly susceptible to the rusts and smuts prevalent in the State.

In Figure 10 are shown panicles and kernels of several varieties of oats representing the commercial types grown in the State. Representative grain samples of a few of the more important commercial varieties are shown in Figure 11.

Frazier: This strain of Fulghum was named for Tom Frazier of Fort Worth, Texas, from whom it was obtained in 1912. Numerous pure-line selections were made from the mass lot of seed. One of these strains was increased and distributed to farmers in 1926 by the Denton station, being recommended for spring seeding. Later tests proved that Frazier is less productive even from spring-seeding than the better Red Rustproof strains, hence, its distribution

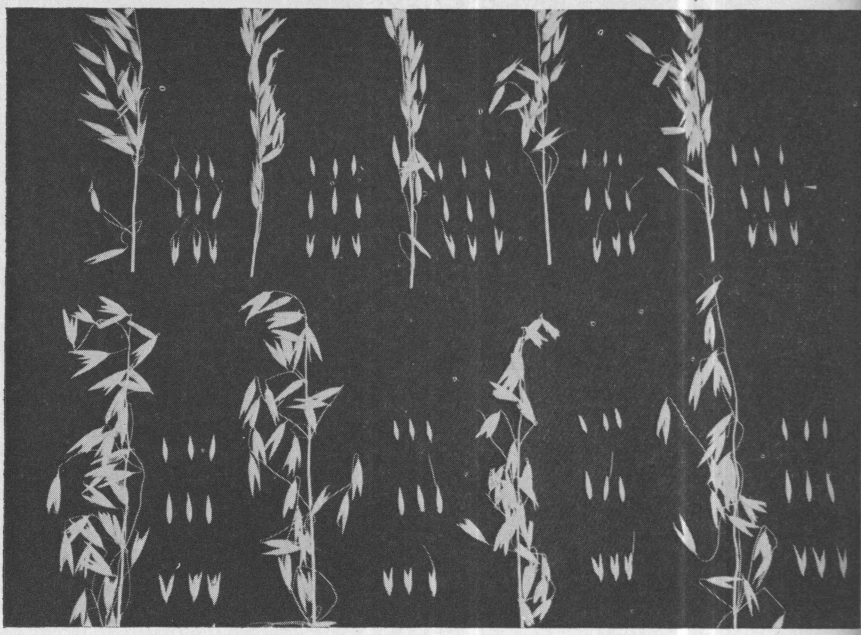


Figure 10. Panicles and grain of some oat varieties grown in Texas. Upper row from left to right: New Nortex as representative of Red Rustproof strains, Fulghum, Frazier, Fultex and Victorgrain. Lower row from left to right: Stanton, DeSoto, Wintok and Fulwin.

has been discontinued. Occasionally when earliness permits the escape of disease or other hazards, Frazier produces high yields. The present acreage of this variety is very small. Frazier is similar to Fulghum, except that a larger proportion of the kernels develop awns.

Kanota: This variety has probably been the most widely and extensively grown Fulghum strain. The variety was named and distributed by the Kansas Agricultural Experiment Station in 1926. having originated as a mass selection from Fulghum. It has been grown extensively in the Midwestern States from Illinois westward to Colorado, and in California. It is grown in the Texas Panhandle from spring seeding. Kanota is typical of the Fulghum variety. Both Kanota and Frazier are less winter-hardy than Red Rustproof strains, and Kanota is apparently less hardy than Frazier.

Fulton: This variety was developed cooperatively by the Kansas Agricultural Experiment Station and the U. S. Department of Agriculture. It was selected from a cross between Fulghum and Markton, a common white oat variety resistant to smut. As compared with Fulghum, Fulton is earlier in maturity; has a larger,

more spreading panicle, a weaker straw, and is resistant to many races of smut. It is lacking in winter-hardiness and should not be fall-sown in Texas. Although it has not been tested extensively, it appears satisfactory and is being grown to some extent commercially from spring-seeding in the Texas Panhandle.

Fultex: This variety was developed cooperatively by the Texas Agricultural Experiment Station and the U. S. Department of Agriculture from a cross between Fulghum and Victoria, a red oat introduced from South America. It was distributed to farmers in 1939. Fultex, though considered a Fulghum type, is considerably different from Fulghum in grain and plant characters. It matures about 5 days later than Fulghum but about 5 days earlier than Nortex. The seedling growth of Fultex is erect and the leaves broad. Plants tiller less than Red Rustproof oats and produce short, strong-strawed plants. The grain is dark red in color with a small black awn which breaks off easily in threshing. The variety is resistant to crown (leaf) rust and to most races of smut, but, is very susceptible to stem rust and to the new Helminthosporium blight

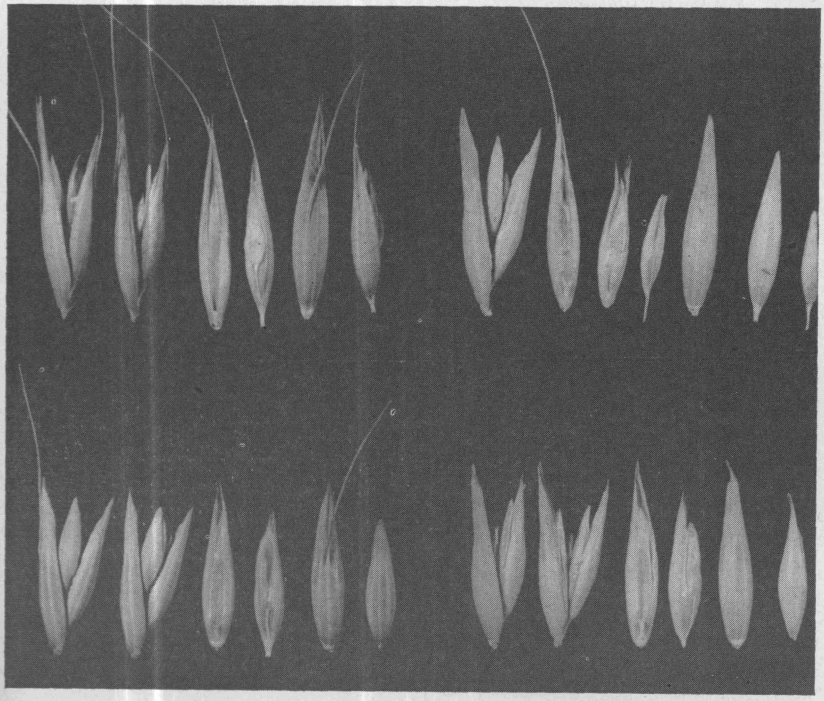


Figure 11. Grain of the more important oat varieties grown in Texas. Upper left: New Nortex as representative of the Red Rustproof strains; upper right: Frazier; lower left, Fultex; and lower right, Victorgrain.

disease. The variety is well suited to direct combine-harvesting because of its strong straw, but, under some conditions, the grain may shatter. Fultex now occupies a considerable acreage in the Rolling Plains area (Region 2) where it has been a consistently high yielder. In Central Texas, it has averaged lower in yield from fall-seeding than the old standard strains of Texas Red Rustproof, but higher from spring seeding. Fultex oats are shown in Figure 12 in comparison with the early maturing Frazier at the left and the later maturing Nortex at the right.

Victorgrain: This variety was developed and distributed by the Coker's Pedigreed Seed Company, Hartsville, S. C. The variety was developed from a cross of Fulgrain and Victoria. The original Fulgrain variety was developed from a cross of Norton and Navarro. Victorgrain is somewhat similar to Fultex in general plant characters. It is resistant to crown (leaf) rust and to smut, and has strong straw that makes the variety suitable for combine harvesting. The grain is larger than that of Fultex, of light red to grayish white in color, and with either a small awn or no awn on the kernels. Victorgrain appears to have no advantage over Fultex for Texas conditions and only a small acreage is grown.

Osage, Neosho and Ventura: These are new varieties of spring-type red oats which are resistant to crown (leaf) rust and stem

Figure 12. Fultex oats (center) growing in experimental variety test plots at the Denton station in 1939. Compare with early maturing variety Frazier (left) and Nortex (right).

rust. They were developed cooperatively by the U. S. Department of Agriculture and the Kansas, Iowa and Idaho Agricultural Experiment Stations. Osage and Ventura are sister selections made from a cross of Victoria-Richland x Fulton. Neosho was selected from a cross of Fulghum-Markton x Victoria-Richland. Osage and Neosho are being distributed by the Kansas Agricultural Experiment Station and Ventura by the California Agricultural Experiment Station. These new varieties have not yet been adequately tested in the State, but it appears that none is sufficiently hardy to be fall-sown. They may have value as a spring-seeded oat.

Miscellaneous Winter-hardy Types

Fulwin and Tennex are winter-hardy sister strains developed by the Tennessee Agricultural Experiment Station as selections from Fulghum selection 699-2011, a winter type Fulghum oat that originated at Arlington, Va., in 1927 as a selection from Fulghum (C. I. 699). The latter strain was obtained by the U. S. Department of Agriculture from the Alabama Agricultural Experiment Station in 1912. Although classed as Fulghum oats, these varieties differ widely from other Fulghum strains. They are among the most winter-hardy oats known, producing a winter growth similar to wheat with prostrate, narrow, dark green leaves. They mature even later than Red Rustproof strains from fall-seeding in Texas and are also late maturing from spring-seeding. Both varieties are highly susceptible to the oat rusts which make them poorly adapted to most sections of Texas. They have produced high average yields from fall-seeding at the Iowa Park and Chillicothe stations and at the U. S. Dry Land Field Station at Lawton in Southern Oklahoma. Recently they have been distributed to farmers in Southern Oklahoma by the Lawton station and are now being grown commercially in that area. They are adapted to fall-seeding in the extreme northern part of Region 2 and in Region 1. They have been used extensively in crosses in an attempt to combine their hardiness with disease resistance.

Fulwin x Lee-Victoria (C. I. 4383) is an unnamed, newly developed strain of oats that has shown unusual promise as a winter-hardy disease-resistant oat. It survived the severe winters of 1943 and 1946 in North Texas when the Red Rustproof strains were killed or seriously thinned. Results of tests made in regional winter-hardiness nurseries conducted in cooperation with the U. S. Department of Agriculture indicate that it approaches the Fulwin parent in hardiness. In addition, it is resistant to crown (leaf) rust.

The early plant growth is prostrate like the Fulwin parent but the mature plants are shorter in stature and mature earlier. The grain is gray in color. This strain and reselections from it have produced high yields from fall-seeding at all stations in the northern part of the State and in Southern Oklahoma. It was developed cooperatively by the U. S. Department of Agriculture and the Denton station and will be distributed as soon as seed can be increased. In Figure 13, Fulwin x Lee-Victoria (C. I. 4383) is shown growing beside the Fulwin parent in 1945 at Denton. The Fulwin parent was killed by rust while the new strain yielded 52 bushels per acre.

Wintok oats were developed cooperatively by the Oklahoma Agricultural Experiment Station and the U. S. Department of Agriculture from a cross of Fulghum (winter type) (C. I. 2500) and Hairy Culberson. Winter-hardiness tests conducted in cooperation with the U. S. Department of Agriculture indicate this is the most winter-hardy oat variety tested. Because of its cold resistance it is valuable for fall seeding in the marginal zone between fall-sown and spring-sown oats. It is highly susceptible to the oat rusts and poorly adapted to Texas conditions for this reason. It is grown to a small extent in Region 1 and 2.

Stanton oats were developed from a cross of Lee, a winter-hardy yellow oat and Victoria, a South American variety previously described. The Lee x Victoria cross was made by the U. S. Department of Agriculture and either bulk hybrid seed or selections were distributed to a number of southern experimental stations. From the

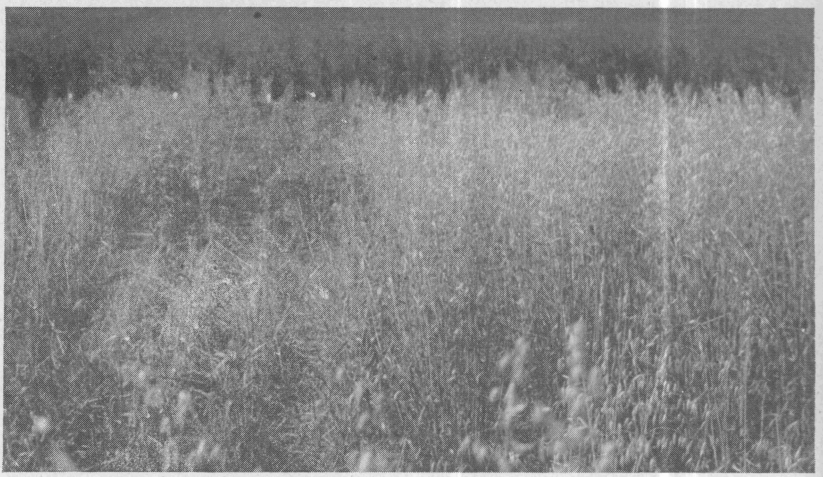


Figure 13. Rust-susceptible Fulwin variety (left) killed by rust. Fulwin x Lee-Victoria (C.I. 4383) rust-resistant (right) which yielded 52 bushels per acre at Denton, Texas, 1945.

cross have been developed the named varieties, Stanton, Letoria, DeSoto, Lelina, Levic, Lelate, Florilee and Leroy. These named strains differ in hardiness, plant characteristics, and adaptation to the various states from which they have been distributed. Stanton oats were selected, named, and distributed by the Coker's Pedigreed Seed Company, Hartsville, S. C. It has been distributed in Texas by commercial dealers and appears, on the basis of preliminary tests, to be the best adapted strain of the group. Stanton is less winter-hardy than Fulwin or Wintok but slightly more winter-hardy than the Red Rustproof strains. It produces a prostrate early growth and the leaves are a distinct blue-green color. Mature plant growth is taller than Red Rustproof with strong straw that stands well for combine harvesting. The panicle is larger and more spreading than Red Rustproof, and the grain is yellow.

DeSoto oats were selected, named, and distributed from the Lee x Victoria cross by the Arkansas Rice Branch Experiment Station at Stuttgart, Ark. They are short in stature, tiller abundantly, and produce a very leafy growth, characteristics that have enabled them to produce very high forage yields at Weslaco, Texas. The grain is red, of moderate size and has a small awn. DeSoto has yielded well in preliminary tests at several locations in the State but does not appear to be superior to present commercial varieties. It is less winter-hardy than either Stanton or the Red Rustproof strains.

Traveler oats were developed from a cross of Victoria and Custis, a winter-hardy oat. It was developed and has recently been distributed by the Arkansas Agricultural Experiment Station. It is resistant to crown (leaf) rust and to smut. The grain is large and dark red in color. Traveler oats are taller than Red Rustproof and have stronger straw. The variety is slightly hardier than Red Rustproof. It has been included in yield tests in the State only a short time, producing good yields, but has not shown superiority over present commercial varieties.

Diseases of Oats

The most common and destructive oat diseases in Texas are the rusts, smuts, and, in recent years, Helminthosporium blight. Occasionally, local losses are caused by other diseases such as halo blight, root rot or blast. Diseases are usually most serious in those sections of the State having high precipitation and humidity combined with intensive cultivation of the crop, namely Regions 2, 3 and 4. Diseases are usually of minor importance in the Panhandle region.

Rusts

The rusts are of major importance in the growing of oats throughout Central Texas and the Rolling Plains areas. They are so destructive in the southern part of the State that, until crown rust-resistant varieties were developed, the growing of oats for grain was impractical. Owing to the mild winters of South Texas, crown rust and stem rust may infect susceptible varieties in the seedling stage during the fall, thereby reducing their value for winter pasture and preventing normal growth to such an extent that little grain is produced. Furthermore, the disease, after overwintering in South Texas, may increase rapidly as spring growth develops and spread northward to menace the crop in the more extensive oat-growing areas of Regions 2 and 3. The development of rust-resistant varieties for South Texas not only reduces the hazards of the grower in that area, but reduces the amount of inoculum that spreads northward to infect the crop in the northern part of the State.

Crown rust: This disease (often called leaf or red rust) is probably the most destructive single disease that attacks oats in Texas. The damage may range from complete destruction of the crop for grain in large areas of South Texas to minor losses in the less humid sections of the State. The average loss from crown rust in Texas,

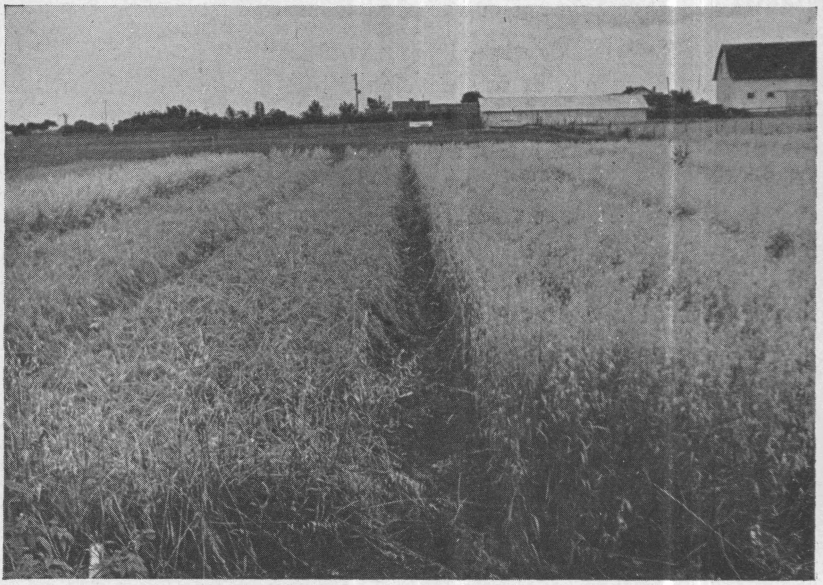


Figure 14. Showing the serious damage that may be caused by crown rust of oats. Fulwin (left) was damaged by rust, yielding only 2 bushels per acre at Denton, Texas, in 1939, while Fultex (right), resistant to rust, yielded 67 bushels per acre.

according to reports of the Division of Mycology and Disease Survey of the U. S. Department of Agriculture, amounted to 2,192,600 bushels annually during the period 1931 to 1939, inclusive. Losses are now being decreased by the expansion in acreage of the rust-resistant varieties Fultex, Victorgrain, Stanton, Ranger, Rustler, Alber, Camellia and Verde. Additional improved varieties will soon be available. The protection from rust losses that may be gained by growing a rust-resistant variety is demonstrated in Figure 14 where the variety Fultex (right) yielded 67 bushels per acre of good quality grain at the Denton station in 1939 when an adjoining plat of Fulwin (left), a susceptible variety, was so damaged by rust that it yielded only 2 bushels per acre. In Figure 15, leaves of resistant varieties Bond, Victoria and Fultex are shown beside those of the susceptible varieties New Nortex and Fulghum.

Crown rust is caused by a fungus that enters the plant, destroys the tissues, and absorbs the plant food normally used by the plant for the development of the grain. The disease shows up as small, salmon red pustules or spots on the leaves and leaf sheaths of the plant. The tiny spores produced in these pustules serve the same purpose as seeds do for ordinary plants, that of reproduction. These spores are spread to other leaves or other plants near by, or may be carried long distances by the wind. They then germinate somewhat like seeds, enter the plant, and in from 8 to 15 days produce new pustules with a new crop of spores. The spread of the disease is favored by showers and frequent dews, since the spores require moisture for germination. This accounts for the erroneous idea often held that rust is caused by rain or dews. No method of control is practical other than that of breeding resistant varieties. Fortunately the plant breeder now has varieties that are resistant to the common races of crown rust and these are being used extensively in crosses with adapted varieties to develop additional varieties suited to Texas conditions.

All the Red Rustproof and older Fulghum strains are susceptible to crown rust, though the Red Rustproof strains are more tolerant than most susceptible varieties. The newly distributed varieties Fultex, Victorgrain, Ranger, Rustler, Camellia, Stanton, De-Soto, Traveler and Verde are resistant to crown rust. Other varieties and strains, resistant to one or both of the oat rusts, are under test and may soon be available commercially.

Stem rust: This is commonly considered the most serious disease of small grains in Texas, although on oats it is usually less destructive than crown rust. The ravages of stem rust (commonly called

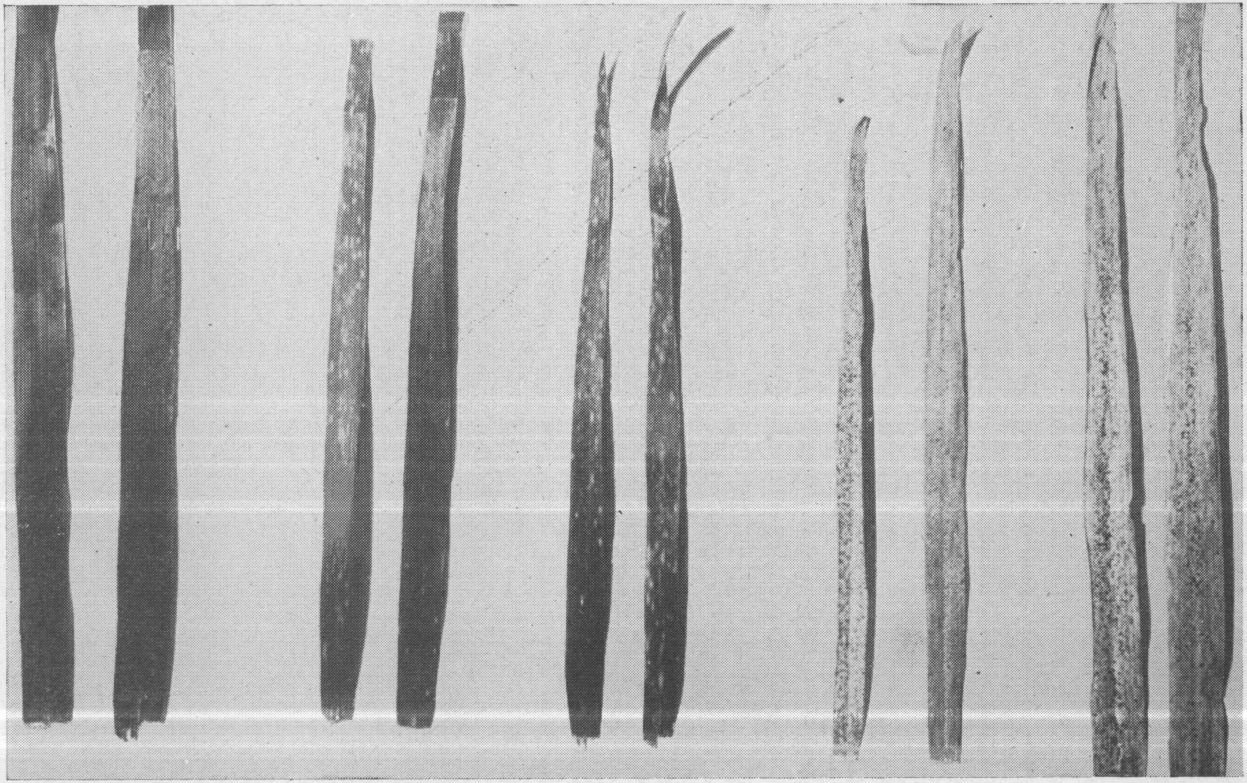


Figure 15. Rust reaction of selected oat varieties in pairs from the left: first, Bond, immune; second and third, Victoria, highly resistant, but with some flecking of leaves caused by rust; fourth, New Nortex, susceptible, and fifth, Fulghum, highly susceptible.

black stem rust) are so apparent, and so spectacular under severe epidemics that it often appears that the disease and destruction occur almost overnight. Like crown rust, this disease is caused by a parasitic fungus, which enters the tissues of the plant, destroys the tissues, and uses the plant food. The disease attacks the stems, leaves, and even the panicle (head). Long, brick red pustules break out on the surface of the plant, and from these, tiny spores spread the disease to other parts of the plant or to other plants. The spores may be carried by the wind to other fields nearby, or many miles away. The disease is favored by warm, humid weather with frequent dews or showers. Stem rust of oats is similar to stem rust of wheat, but is not exactly the same since stem rust of oats does not attack wheat or barley, and vice versa. The breeding of rust-resistant varieties is the only practical method of controlling the disease. With the exception of Verde, recommended for the Lower Rio Grande Valley and Coastal Plains area, all varieties of oats now available commercially in Texas are susceptible to stem rust. New stem rust-resistant varieties and strains, as mentioned in the foregoing discussions, are being developed or tested under Texas conditions, and may soon be made available.

Smuts

Two types of smut, loose smut and covered smut, attack oats. Loose smut destroys the entire head or panicle including the glumes and seed. Covered smut destroys only the seed in most instances, leaving the glumes surrounding and holding the mass of black smut spores. Usually, covered smut invades the glumes only slightly. Often, however, it is hard to distinguish the two types of smut and, as the seed treatment is the same for the control of both kinds, they are treated as one disease in this discussion.

Smut, like rust, is caused by a microscopic, parasitic fungus that enters the tissues of the plant, absorbs the plant food, and replaces the seed with a mass of smut spores. At threshing time, the smut spores are spread to healthy seed, where they remain until the seed is planted. As the seed germinates, the smut spores germinate also and enter the tissues of the young plant. The fungus grows within the plant tissues until the plant matures, then the seed or the seed and glumes are replaced by masses of smut spores.

The two types of smut of oats are shown in Figure 16 in comparison with a normal plant.

In contrast with the rusts, the smuts may easily be controlled by seed treatment. Effective control may be obtained by dusting the

Figure 16. Panicles or heads of oats infected with covered smut (left), normal plants (center) and infected with loose smut (right).

seed with one of the commercial dusts such as New Improved Ceresan, or by treating the seed with formaldehyde. One of the most effective and easily applied treatments is that of dusting the seed with New Improved Ceresan. *Mercury dusts of this type are poisonous and precautions noted by the manufacturer should be carefully observed.* The New Improved Ceresan is applied at the rate of one-half ounce per bushel by means of a gravity or rotary seed treater, or simply by adding the dust to a pile of grain and then shoveling it over repeatedly until the dust and grain are thoroughly mixed. Mixing in the drill box is not recommended.

A small home-made device known as the Minnesota Seed Grain Treater,[1] has proved highly satisfactory for applying the dust. With this device, two men can treat upwards of 40 bushels of seed per hour. Anyone handy with a hammer and saw can make the device. Another kind of home-made duster, consisting of a rotating barrel with a baffle board, can also be constructed.[2] For larger quantities of seed, a cement mixer or a commercial treating machine is preferred. Several makes of satisfactory seed treating machines are available.

Directions for applying New Improved Ceresan or other dust treatments are given on the label of each can and should be fol-

[1]Directions for its construction and use are given in U. S. Department of Agriculture Miscellaneous Publication No. 219 entitled, "Treat Seed Grain."

[2]Its construction and use are described in U. S. Department of Agriculture Miscellaneous Publication No. 199 entitled, "Barley Diseases Controlled by Seed Treatment."

lowed closely. With New Improved Ceresan, seed should be treated about two weeks before planting, but seed should not be held more than a few months after treating or viability of the seed may be injured. Surplus seed treated with these poisonous dusts should not be fed to livestock.

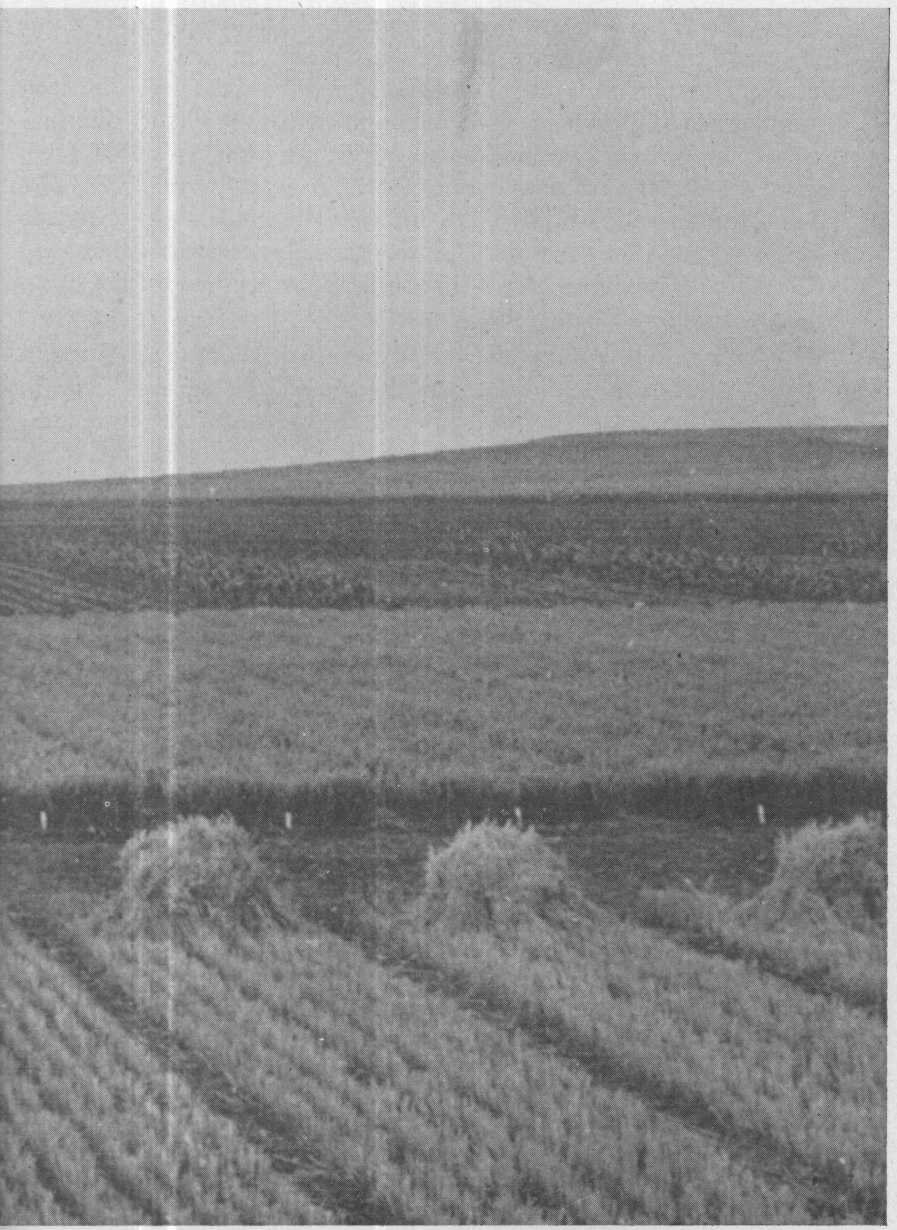
Another method of seed treatment is with liquid formaldehyde. It is the most economical method but, under some conditions, may cause a reduction in germination. This most often occurs when seed is sown in dry soil or when seeding is delayed following treatment of the grain. Treatment with liquid formaldehyde costs only about one cent per bushel, but is more laborious and disagreeable to handle than dust treatments. The formaldehyde may be applied by spraying it on the seed or by making a solution and dipping the seed in it. One pint of formaldehyde is sufficient to treat 50 bushels of oats by mixing it with one pint of water and spraying it on the seed, mixing it with 5 gallons of water and sprinkling it on the seed, or mixing it in 50 gallons of water and dipping the seed.

For the spray or sprinkle method the oats are placed in small piles on the floor of a bin, and the formaldehyde is applied by sprinkling or spraying the solution onto the oats as they are shoveled into new piles. This should be repeated until all seed is uniformly moistened with the solution. After treatment, the grain should be left covered with a tarpaulin for two hours or over night. If it is not planted immediately, it should be spread out to dry. Germination of the seed may be impaired if seed is stored more than a few weeks after treatment, so the treating should be done immediately before planting.

Dipping the grain into a solution of formaldehyde is equally effective. For this method the grain is placed in loose burlap or gunny-bags, half filled and tied at the top. They are dipped into a barrel of the solution for an hour. They are then removed, the surplus water drained off, and the seed spread out to dry.

Care should be taken to see that the seed does not heat or freeze. If the seed swells the rate of planting will have to be adjusted accordingly. In treating seed with formaldehyde, care should be taken to keep the solution and fumes out of the eyes. After drying, surplus seed treated with formaldehyde may be fed to livestock without danger.

Figure 17. Oat variety trials at Denton, Texas, 1940. Fa



ested (foreground) and spring-sown tests in background.

Helminthosporium Blight

Although *Helminthosporium, Fusarium, Pythium* and other soil fungi have probably always caused some losses in oats through reduction of stands and rotting of the roots, their damage has been largely overlooked or considered minor in extent. With the distribution of new oat varieties in the United States that resulted from crosses on Victoria, a new species of *Helminthosporium* (*H. victoriae,* Meehan and Murphy) has increased to epidemic proportions to cause serious losses in oats. The varieties most seriously damaged in Texas are the new crown-rust-resistant varieties Fultex, Victorgrain, Ranger, Rustler and Verde.

The Helminthosporium blight (also called Victoria blight and root rot) attacks the plants of oats at nearly all stages of growth. In untreated seed, the seedlings are attacked as the seed germinates, many are killed and others weakened. Plants that survive or escape early infection show infection in the later stages of growth by the production of orange to brown discolored lesions or streaks on the leaves. The nodes or joints of the stem become dark in color and are weakened so that many plants break over. Other plants are attacked at the crown and become so weak that lodging at the ground level occurs. When the plants are pulled it is found that roots are few in number, and badly discolored or dead. The grain produced is shriveled and light in test weight. Because of the heavy infection of the fungus on the seed, the grain frequently heats in storage.

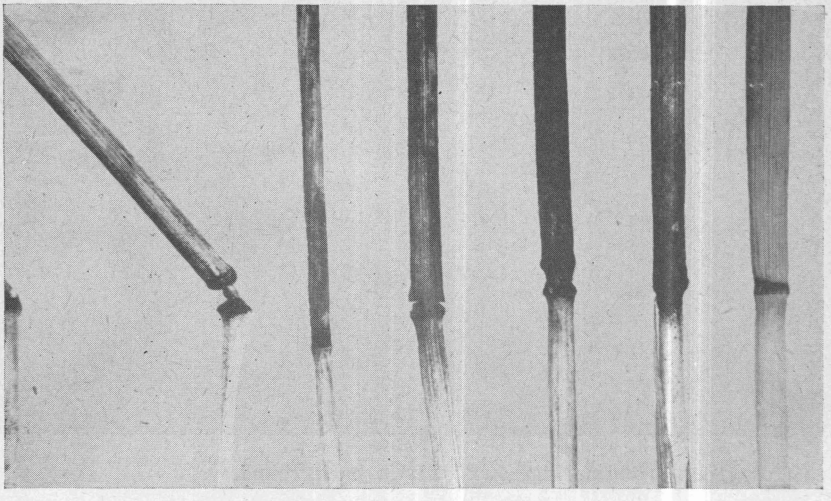


Figure 18. Diseased, blackened nodes of oats infected with Helminthosporium blight (first five from left) shown in comparison with normal stem and node at extreme right. (Courtesy Iowa Agricultural Experiment Station.)

Infected stems and roots of diseased plants are shown in Figures 18 and 19 in comparison with normal ones.

The fungus that causes the disease is probably present in most soils and increases rapidly when susceptible varieties are seeded on the land. It is also spread by infected seed. Relatively little is known about the influence of rotation, tillage and other crops on the spread and development of the disease, but limited tests in other states indicate that rotation of corps, together with seed treatment, aids in the control of the disease. Based on controlled experiments, it appears that the disease will be more serious in the warm, humid sections of the State than in the areas of more limited rainfall. Seed-borne infection can be largely controlled by treating the seed with New Improved Ceresan or other mercury dusts as for the control of smut. Seed should be cleaned thoroughly to remove shriveled, infected kernels and the seed then treated as for smut about two weeks before planting. Fortunately, the Red Rustproof strains are much more resistant to the disease than varieties derived from crosses with Victoria. Where the disease becomes serious and the Red Rustproof varieties are adapted, they should be planted. In South Texas, it is suggested that Alber and Camellia may be more resistant to Helminthosporium blight than Ranger and Rustler.

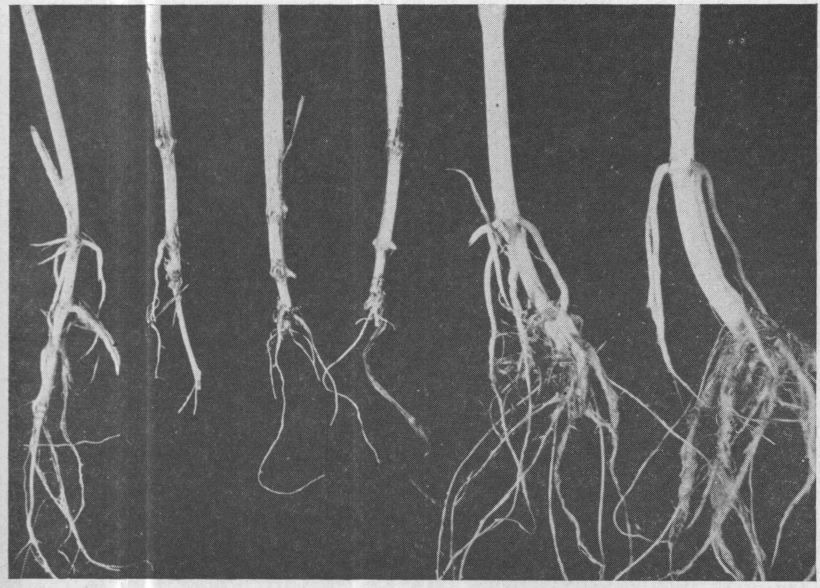


Figure 19. Four discolored, rotted root systems of plants infected with Helminthosporium blight compared with two normal root systems at right. (Courtesy Iowa Agricultural Experiment Station.)

Miscellaneous Diseases

Several other diseases may attack oats in certain seasons or in certain sections of the State. Fusarium, Pythium and the common species of Helminthosporium, often cause some reduction in stand and some leaf spotting, but usually are not serious. Seed treatment is an aid in producing strong, early growth of seedlings. Occasionaly halo blight, a bacterial disease that causes large brown lesions on the leaf, causes damage to oats in the more humid sections of the State. The growing of resistant varieties is the only method of control for this disease.

Winter-hardiness of Oat Varieties

Oats are the least hardy of the three commonly grown small grain crops. Winter-killing is an important hazard of production under Texas conditions. Injury to the crop from low temperatures often occurs after periods of relatively warm weather, which may happen any time during the winter months. Under such conditions, plants are poorly hardened and all varieties may be killed regardless of their relative cold resistance, while at other times oats may be hardened and differential killing in proportion to true hardiness of varieties may occur. In the 35-year period, 1911 to 1946 inclusive, oats have been completely winterkilled six seasons at the Denton station. In addition, differential killing occurred in 1924, 1927, 1942, 1943 and 1944.

As fall-sown oats are more productive than spring-sown oats in most seasons, more hardy oats are desirable for the fall-sown oat area of the United States. Tests of the winter-hardiness of oat varieties have been conducted cooperatively by the U. S. Department of Agriculture and state experimental stations since 1927. Detailed reports of the survival of all strains tested are prepared each year. A summary of results is published under the title, "Survival of Oats Grown in Winter-hardiness Nurseries, 1932-1941" in the American Society of Agronomy Journal 34(7): 651-658, July, 1942. Data on the comparative hardiness of a selected group of strains in this nursery from 1937 to 1942 inclusive, and similar data obtained at Denton, Texas, from 1942 to 1947 inclusive are given in Table 3. Data are recorded in percentage survival and in percentage of the check variety, Winter Turf.

Data on survival at Denton, Texas, and throughout the Southern States are in agreement. The most hardy strains are Wintok, Fulwin, Tennex, Forkedeer and Hairy Culberson. Both Letoria and Stanton appear to be more hardy than their parent Lee; while De-

Table 3. Comparative winter-hardiness of selected oat varieties in the U.S.D.A. uniform winter-hardiness nursery, 1937 to 1942 inclusive, and at Denton, Texas, 1942 to 1947, inclusive

C. I. No.	Variety	Percent survival—average for number test shown					Weighted average of tests	Percent of Winter Turf for same years	No. of tests	Percent survival at Denton*					
		1937	1938	1939	1940	1941				1942	1943	1944	1947	Average	No. years
	Number tests	22	31	24	29	29									
3296	Winter Turf	83.5	67.6	79.9	72.2	58.5	71.4	100	135	90	3	94	30	54.2	4
2505	Hairy Culberson	88.1	71.3	77.2	75.3	64.8	74.6	104.8	134	100	50	100	80	82.5	4
3424	Wintok	.....	75.1	78.7	77.6	67.2	74.5	108.1	112	100	50	100	85	83.8	4
2042	Lee	83.8	62.0	76.4	70.2	54.9	95.7	95.7	135	40	0	90	10	35.0	4
3392	Letoria	.....	.....	81.1	74.7	65.5	73.3	105.3	82	93	0	100	69	65.5	4
3855	Stanton Strain 1	.....	.....	.....	.....	64.0	64.0	109.4	29	75	0	93	55	55.8	4
3923	De Soto	.....	.....	.....	.....	.....	.....	.....	.....	10	0	93	45	37.0	4
3170	Forkedeer	89.2	.....	.....	.....	.....	89.2	106.8	22	.....	20	100	.....	60.0	2
3169	Tennex	90.1	75.6	83.0	73.5	68.8	77.4	108.4	135	100	18	.....	.....	58.0	2
3168	Fulwin	91.2	76.1	80.2	74.5	70.9	77.8	108.9	135	95	30	100	95	80.0	4
4383	Fulwin x Lee-Victoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	98	85	77.7	3
4316	Fulwin x Lee-Victoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	98	.....	51.5	2
4206	Traveler	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	99	84	61.0	3
708	Fulghum	88.0	70.0	77.4	70.9	65.7	73.5	102.9	135	10	0	88	32	32.5	4
3531	Fultex	.....	.....	.....	66.7	59.1	62.9	96.2	58	50	0	90	28	42.0	4
3692	Victorgrain	.....	.....	.....	58.7	57.5	58.1	88.8	58	25	0	93	35	38.3	4
4079	Camellia	.....	.....	.....	.....	.....	.....	.....	.....	0	0	30	.....	10.0	3
1815	Appler Rustproof	74.4	58.4	70.3	59.5	53.7	62.3	87.3	135	5	0	90	28	30.8	4
2382	Nortex	73.1	57.1	.....	.....	.....	63.7	85.8	53	19	0	86	18	30.8	4
3422	New Nortex	77.6	62.1	71.8	61.9	58.4	65.5	91.7	135	48	0	95	32	43.8	4
3754	Rustler	.....	.....	.....	.....	53.8	53.8	92.0	29	3	0	70	.....	24.3	3
3417	Ranger	.....	.....	65.8	.....	51.2	57.7	84.6	53	5	0	79	35	29.8	4
3733	Rangler	.....	.....	.....	.....	54.5	54.5	93.2	29	3	0	83	.....	28.7	3

*No winter-killing in 1945 or 1946.

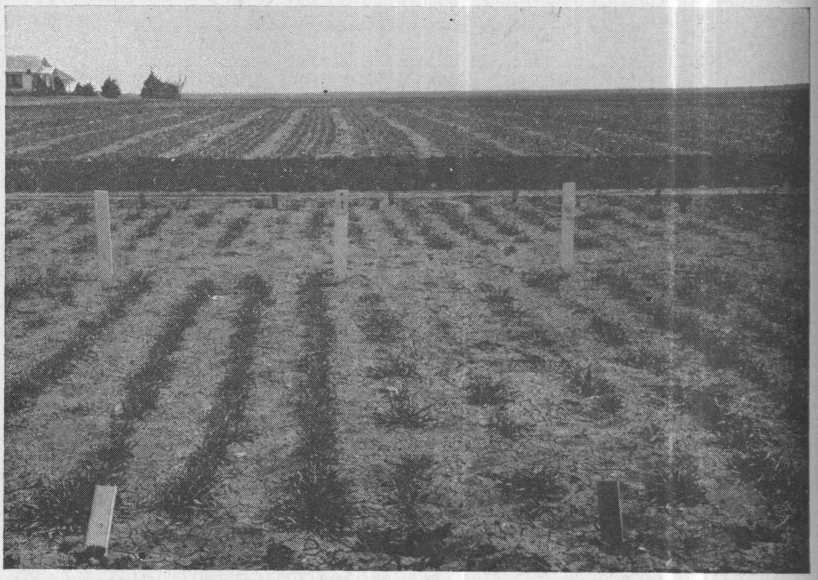


Figure 20. Showing the high survival of Fulwin x Lee-Victoria (C.I. 4383) in 4-row nursery plots (left) when New Nortex (right) and other surrounding strains were severely injured by low temperatures at Denton, Texas, in 1947.

Soto is about as hardy as Lee. Fulghum appears to be more hardy then Red Rustproof on the basis of the regional tests but less hardy in Texas. New Nortex is more hardy than its Appler Rustproof parent and more hardy than Nortex. This agrees with observations under commercial conditions. Ranger, Rustler and Rangler are less hardy than their Nortex parent and probably should not be grown north of the Waco, Texas, area. Camellia is also very tender and should be grown only in South Texas. The most promising new strain is Fulwin x Lee-Victoria C.I. 4383. This strain has, for practical purposes, been equal to its Fulwin parent in hardiness and is much superior in rust resistance, which has contributed to much higher average yields. These results are in agreement with unpublished data of recent years in the regional tests. The high survival of C.I. 4383 in 1943 when most strains were winter-killed, is shown in Figure 20.

Experimental Results

Tests of oat varieties and strains, together with breeding work to develop improved varieties, are being conducted at several locations in the State. The location of the substations cooperating in the work reported herein is shown in Figure 2. The most extensive work has been done at the Denton station in Region 3 of North-

central Texas, where work has been in progress since 1912. After the introduction of the crown-rust-resistant varieties Victoria and Bond, in 1927 and 1929, respectively, the breeding work in South Texas was expanded to develop adapted rust-resistant varieties for that area. As nearly all adapted varieties are of comparatively recent origin, yield data obtained only in recent years are presented in this publication.

Through the courtesy of the Division of Cotton and Other Fiber Crops, Bureau of Plant Industry, Soils, and Agriculture Engineering, U. S. Department of Agriculture, data on oat variety trials conducted at the U. S. Cotton Field Station at Greenville, Texas, are presented.

Variety Trials at Denton*

The Denton station is located 5 miles west of Denton, Texas, in the Grand Prairie area. This is a diversified farming section with cotton, oats, wheat and corn being the major crops. Large acreages are also devoted to barley, grain sorghum, hay and pasture crops. The 30-year mean annual precipitation is 32.6 inches, with the highest average precipitation being received in April, May and October. Temperatures are relatively mild, although subject to wide and rapid fluctuations which at times cause winter-killing of oats and barley. Complete winter-killing of oats occurred in six seasons since the establishment of the Denton station in 1912. Differential injury winter-killing occurred in the five additional seasons of 1924, 1927, 1942, 1943 and 1944. Wheat was winter-killed in 1916 and injured by heaving and low temperatures in 1933 and 1935. The 28-year annual mean temperature is 64.7° F.; the record minimum temperature is -3° F. In this area, fall-sown oats yield on the average approximately 10 bushels more per acre than spring-sown oats, so approximately 75 percent of the crop is fall-sown. The balance of the acreage is normally spring-sown but, in seasons when winter-killing occurs, the majority of the harvested acreage may be spring-sown. Variety tests of oats have been conducted since 1912. Data on yields from both fall and spring seeding and tests conducted in field plots and nursery plots are reported in Tables 4 to 7, inclusive. In Figure 17 are shown the field plot variety trials with the fall-sown test harvested in the foreground and the spring-sown test in the background.

Yields of fall-sown oats: Data on yields are presented in Tables 4 and 5 for only the more recent period of 1929 to 1946, inclusive.

*Small grain tests at Denton were conducted in cooperation with the late P. B. Dunkle, superintendent.

Table 4. Yields of fall-sown oat varieties grown in replicated 1/44-acre field plots, 1929-1946, inclusive, at Texas Substation No. 6, Denton, Texas

Number		Variety or strain	Yield of grain—bushels per acre													Average	
C. I.	T. S.		1929	1931	1932	1934	1936	1937	1938	1939	1940	1941	1944	1945	1946	For years grown	Standard varieties same period
2382	9235	Nortex*	61.7	85.9	73.8	71.7	76.6	77.7	92.7	76.8	78.5	20.7	67.2	46.0	85.0	83.1	80.6
3422	26155	New Nortex*	67.6	87.5	81.3	78.8	79.2	84.3	92.9	77.8	77.8	21.4	71.6	43.7	98.1	87.5	80.6
2150	9400	Ferguson 922*	61.0	88.7	78.6	75.8	75.2	71.3	95.5	77.2	75.4	24.0	65.6	40.4	95.4	84.0	80.6
2503	1118–69	Texas Red Rustproof*	66.7	88.9	73.6	75.8	76.6	76.6	91.8	73.9	79.8	21.6	64.2	46.9	90.4	84.2	80.6
2381	9234	Frazier*	55.8	69.5	36.1	54.7	59.9	77.9	78.5	61.2	63.8	13.9	45.0	33.4	58.8	64.4	80.6
		Total	312.8	420.5	343.4	356.8	367.5	387.8	451.4	366.9	375.3	101.6	313.6	210.4	427.7	.....	.....
		Average	62.6	84.1	68.7	71.4	73.5	77.6	90.3	73.4	75.1	20.3	62.7	42.1	85.5	80.6	80.6
.....	1415–12	Texas Red Rustproof	.....	.....	83.7	74.4	85.8	86.1	98.7	76.8	78.0	22.8	.....	.....	.....	75.8	68.8
.....	2805–39	Texas Red Rustproof	.....	.....	80.3	75.0	74.8	77.9	.....	.....	.....	.....	.....	.....	.....	77.0	72.8
.....	2805–43	Texas Red Rustproof	.....	.....	80.0	77.8	74.9	77.9	.....	.....	.....	.....	.....	.....	.....	77.6	72.8
.....	6217–43	Texas Red Rustproof	.....	.....	80.6	77.7	79.7	74.8	.....	.....	.....	.....	.....	.....	.....	78.2	72.8
3417	27871	Ranger	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.3	.....	.....	.....	13.3	20.3
3754	27908	Rustler	.....	.....	.....	.....	.....	.....	.....	.....	67.0	13.4	.....	.....	.....	40.2	47.7
3733	.....	Rangler	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65.2	39.9	.....	52.6	53.4
.....	.....	Nortex x Victa. 11-34-3	.....	.....	.....	.....	.....	.....	97.0	.....	.....	.....	.....	.....	.....	97.0	90.3
3534	.....	Nortex x Victa. 11-34-103	.....	.....	.....	.....	.....	.....	95.6	73.2	.....	.....	.....	.....	.....	84.4	81.8
3535	.....	Nortex x Victa. 11-35-41	.....	.....	.....	.....	.....	.....	.....	75.9	74.2	20.5	.....	.....	.....	56.9	56.3
3536	.....	Applier x Bond, 15-34-64	.....	.....	.....	.....	.....	.....	88.0	73.9	72.6	15.6	.....	.....	.....	62.5	64.8
2498	15927	Fulghum (winter type)	64.9	75.7	80.7	62.3	81.1	.....	.....	.....	.....	.....	.....	.....	.....	71.4	72.0
2909	19564	Norton No. 3	.....	.....	.....	57.7	59.8	.....	.....	.....	.....	.....	.....	.....	.....	58.9	72.4
3531	28889	Fultex	.....	.....	.....	.....	.....	.....	92.2	67.0	67.0	10.7	57.0	39.7	89.2	60.4	64.2
3529	.....	Fulghum x Victa. 12-34-13	.....	.....	.....	.....	.....	.....	.....	68.3	65.0	.....	.....	.....	.....	66.7	74.2
3533	.....	Kanota x Victa. 13-33-70	.....	.....	.....	.....	.....	.....	96.1	.....	.....	.....	.....	.....	.....	96.1	90.3
3692	.....	Victorgrain	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65.4	47.1	80.5	64.3	63.4
3923	.....	DeSoto	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60.4	48.1	84.7	64.4	63.4
3392	.....	Letoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	68.6	43.5	.....	56.0	52.4
3855	.....	Stanton (Strain 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	67.2	42.2	88.7	66.0	63.4
4315	.....	Stanton (Strain 43-33)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.6	82.8	61.2	63.8
4383	.....	Fulwin x Lee-Victa. 3770	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	70.7	49.6	80.7	67.0	63.4
.....	.....	Fulwin x Lee-Victa. 3832	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63.4	41.9	.....	52.6	52.4
4603	.....	R. R. P.[2] x Vict.-Rich. 39-39-89 (a)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.0	37.9	88.4	57.8	63.4
.....	.....	R. R. P.[2] x Vict.-Rich. 39-39-163	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48.2	.....	.....	48.2	62.4
.....	.....	R. R. P.[2] x Victa-Rich. 39-40-146	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31.8	.....	31.8	42.1
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-210	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.9	80.1	56.5	63.8
4604	.....	R. R. P.[2] x Victa.-Rich. 39-40-223	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	42.2	90.6	66.4	63.8
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-231	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	27.5	.....	27.5	42.1
4462	.....	R. R. P.[2] x Victa.-Rich. 39-40-250	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.7	83.4	60.0	63.8
4661	.....	R. R. P.[2] x Victa.-Rich. 39-40-272	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38.8	86.5	62.6	63.8
4662	.....	R. R. P.[2] x Victa.-Rich. 39-40-427	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.1	73.0	61.6	63.8

*Standard varieties, mean of which is used to compare with other varieties grown for less than the full period.

Table 5. Yields of fall-sown oat varieties and strains grown in replicated nursery plots, 1931-1946, inclusive, at Texas Substation No. 6, Denton, Texas

Number		Variety or strain	Yield of grain—bushels per acre												Average	
C. I.	T. S.		1931	1932	1936	1937	1938	1939	1940	1941	1943	1944	1945	1946	For years grown	Standard varieties same period
2382	9235	Nortex*	93.1	76.0	95.2	93.8	95.7	89.6	99.2	53.9	0	68.2	53.3	82.5	75.0	73.1
3422	26155	New Nortex*	111.6	87.8	90.8	99.1	92.9	86.2	94.0	55.7	0	71.0	55.3	96.2	78.4	73.1
2150	9400	Ferguson 922*	102.2	85.4	83.6	85.0	90.1	81.0	105.5	53.1	0	69.2	55.2	90.2	75.0	73.1
2381	9234	Frazier*	71.0	52.1	68.8	78.6	95.9	67.1	83.2	44.8	0	43.5	36.1	60.2	58.4	73.1
2503	1118–69	Texas Red Rustproof*	98.9	72.0	98.4	86.4	99.0	91.4	106.2	46.4	0	68.3	56.7	91.4	76.3	73.1
.....	2805–43	Texas Red Rustproof*	84.8	66.4	98.2	86.0	93.1	90.8	106.1	59.0	0	69.3	50.6	84.6	74.1	73.1
.....	6217–43	Texas Red Rustproof*	81.0	75.0	99.8	90.0	84.4	93.6	104.1	54.8	0	71.6	50.8	90.7	74.7	73.1
		Total	642.6	514.7	634.8	618.9	651.1	599.7	698.3	367.7	0	461.1	358.0	595.8	.....	.....
		Average	91.8	73.5	90.7	88.4	93.0	85.7	99.8	52.5	0	65.9	51.1	85.1	.....	.....
.....	1415–12	Texas Red Rustproof	77.1	78.4	94.4	93.9	90.0	91.0	108.0	58.1	0	75.1	50.3	.....	74.2	72.0
1815	.....	Appler Rustproof	.....	.....	.....	.....	.....	.....	.....	.....	0	59.8	52.0	89.0	50.2	50.5
4220	.....	Delta Red	.....	.....	.....	.....	.....	.....	.....	.....	0	33.0	51.2	86.4	42.6	50.5
4313	.....	Carolina Red	.....	.....	.....	.....	.....	.....	.....	.....	.....	64.2	57.0	88.1	69.8	67.4
3934	.....	Red Rustproof (Ala. 43a)	.....	.....	.....	.....	.....	.....	.....	.....	.....	55.9	46.9	83.2	63.0	67.4
3417	27871	Ranger	.....	.....	.....	.....	89.4	82.9	94.6	40.5	0	57.1	67.6	83.9	64.5	66.6
3733	.....	Rangler	.....	.....	.....	.....	.....	.....	.....	.....	0	57.8	51.0	.....	36.3	39.0
3754	27908	Rustler	.....	.....	.....	.....	95.6	83.6	89.0	29.8	0	.....	.....	.....	59.6	66.2
.....	.....	Nortex x Victa. 11-38-78	.....	.....	93.8	72.3	91.2	84.2	95.8	.....	.....	.....	.....	.....	87.5	91.5
3534	.....	Nortex x Victa. 11-34-103	.....	.....	.....	83.8	90.4	93.0	97.4	51.1	.....	.....	.....	.....	83.1	83.9
.....	.....	Nortex x Victa. 11-34-104	.....	.....	.....	77.8	91.8	85.0	.....	.....	.....	.....	.....	.....	84.8	89.0
.....	.....	Nortex x Victa. 11-34-191-4	.....	.....	.....	.....	92.4	82.6	99.2	.....	.....	.....	.....	.....	91.4	92.8
.....	.....	Nortex x Victa. 11-34-193	.....	.....	.....	92.0	95.8	81.4	93.9	.....	.....	.....	.....	.....	90.8	91.7
3535	.....	Nortex x Victa. 11-35-41	.....	.....	.....	.....	95.6	92.4	91.2	42.3	.....	.....	.....	.....	80.4	82.7
.....	.....	Nortex x Victa. 11-35-52	.....	.....	.....	.....	.....	92.1	96.1	48.6	.....	.....	.....	.....	78.9	79.3
.....	.....	Nortex x Victa. 11-35-171	.....	.....	.....	.....	.....	92.1	96.1	48.6	.....	.....	.....	.....	78.2	79.3
.....	.....	Nortex x Victa. 11-36-134	.....	.....	.....	.....	.....	78.6	81.5	31.8	.....	.....	.....	.....	64.0	79.3
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-172 (a)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.3	.....	32.3	51.1
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-201	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.4	60.6	76.0	47.1	67.4
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-219	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.9	47.0	.....	42.0	58.5
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-243	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.7	.....	44.7	51.1
.....	.....	R. R P.[2] x Victa.-Rich. 39-40-290	.....	.....	.....	.....	.....	.....	.....	.....	.....	34.2	49.3	.....	42.0	58.5
4662	.....	R. R. P.[2] x Victa.-Rich. 39-40-427	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.1	69.6	59.8	68.1
3424	.....	Wintok	.....	.....	.....	.....	.....	.....	85.9	35.2	29.8	67.3	.....	.....	54.6	54.5
3169	.....	Tennex	.....	.....	.....	.....	.....	.....	.....	35.2	30.0	.....	.....	.....	32.6	26.2
3168	.....	Fulwin	.....	.....	.....	.....	.....	.....	.....	41.8	21.9	67.8	2.6	52.1	37.2	50.9
2498	15865	Fulghum (winter type)	86.5	68.7	70.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	75.3	85.3
2500	20446	Fulghum (winter type)	97.8	75.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	86.4	82.7
708	20472	Fulghum	.....	58.3	65.6	79.2	87.8	65.6	82.2	52.6	0	47.7	38.5	62.3	58.2	71.4

Table 5. Yields of fall-sown oat varieties and strains grown in replicated nursery plots, 1931-1946, inclusive, at Texas Substation No. 6, Denton, Texas—(Continued)

Number		Variety or strain	Yield of grain—bushels per acre												Average	
C. I.	T. S.		1931	1932	1936	1937	1938	1939	1940	1941	1943	1944	1945	1946	For years grown	Standard varieties same period
.....	18565	Coker Fulghum No. 4	.....	81.5	68.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	75.2	82.1
2909	18564	Norton	.....	.....	63.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	63.2	90.7
3531	28889	Fultex	.....	.....	.....	79.2	95.6	82.4	91.2	53.8	0	64.4	60.6	86.6	68.2	69.1
.....	.....	Fulghum x Victa. 12-33-60	.....	.....	.....	0	83.4	.....	.....	.....	.....	.....	.....	.....	41.7	90.7
3528	.....	Fulghum x Victa. 12-33-90	.....	.....	.....	0	78.2	82.7	97.2	47.8	.....	.....	.....	.....	61.2	83.9
3529	.....	Fulghum x Victa. 12-34-13	.....	.....	.....	73.4	93.4	76.4	97.8	47.0	0	.....	.....	.....	64.7	69.9
.....	.....	Fulghum x Victa. 12-34-53	.....	.....	.....	0	78.6	.....	.....	.....	.....	.....	.....	.....	39.3	90.7
3533	.....	Kanota x Victa. 13-33-70	.....	.....	.....	79.2	102.7	97.4	98.6	55.5	.....	.....	.....	.....	86.7	83.9
.....	.....	Kanota x Victa. 13-34-12	.....	.....	.....	.....	86.4	77.4	95.8	.....	.....	.....	.....	.....	86.5	92.8
.....	.....	Kanota x Victa. 13-34-13	.....	.....	.....	79.4	97.7	93.1	100.0	55.6	.....	.....	.....	.....	85.2	83.9
.....	.....	Appler x Bond, 15-34-63	.....	.....	.....	82.5	95.0	97.6	101.8	37.6	.....	.....	.....	.....	82.9	83.9
3536	.....	Appler x Bond, 15-34-64	.....	.....	.....	75.2	92.3	84.0	99.6	40.0	.....	.....	.....	.....	78.2	83.9
3692	.....	Victorgrain	.....	.....	.....	.....	.....	.....	.....	50.4	0	68.0	56.1	77.9	51.3	50.9
3693	.....	Fulgrain Strain 4	.....	.....	.....	.....	.....	.....	.....	44.8	0	.....	.....	.....	22.4	26.2
3991	.....	Osage	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.6	42.5	64.7	38.9	67.4
2401	18562	Victoria	64.5	43.2	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	35.9	85.3
2733	20451	Bond	.....	.....	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	0	90.7
3923	.....	DeSoto	.....	.....	.....	.....	.....	.....	.....	.....	0	59.2	63.8	85.2	52.0	50.5
3392	.....	Letoria	.....	.....	.....	.....	.....	.....	.....	.....	0	72.3	54.3	73.9	50.1	50.5
3855	.....	Stanton Strain 1	.....	.....	.....	.....	.....	.....	.....	.....	0	72.8	43.8	76.0	48.2	50.5
4315	.....	Stanton Strain 43-33	.....	.....	.....	.....	.....	.....	.....	.....	.....	76.2	50.7	81.0	69.3	67.4
3404	.....	Lelina	.....	.....	.....	.....	.....	.....	.....	.....	0	62.6	.....	.....	31.3	32.9
3379	.....	Lega	.....	.....	.....	.....	.....	.....	.....	.....	0	72.6	48.2	.....	40.3	39.0
3398	.....	LeRoy	.....	.....	.....	.....	.....	.....	.....	.....	.....	64.3	43.4	.....	53.9	67.4
4080	.....	Lemont	.....	.....	.....	.....	.....	.....	.....	.....	.....	66.9	11.2	64.8	47.6	67.4
4079	.....	Camillia	.....	.....	.....	.....	.....	.....	.....	.....	0	55.4	50.7	.....	35.4	39.0
4206	.....	Traveler 1	.....	.....	.....	.....	.....	.....	.....	.....	0	64.2	55.9	86.9	51.8	50.5
4318	.....	Victoria x Norton	.....	.....	.....	.....	.....	.....	.....	.....	.....	61.7	60.3	.....	61.0	58.5
4383	.....	Fulwin x Lee-Victa. 3770	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.2	69.8	60.0	68.1
4218	.....	Fulwin x Lee-Victa. 3771	.....	.....	.....	.....	.....	.....	.....	.....	0	73.9	43.9	.....	39.3	39.0
4316	.....	Fulwin x Lee-Victa. 3788	.....	.....	.....	.....	.....	.....	.....	.....	.....	62.8	41.9	85.9	63.5	67.4

*Standard varieties, mean of which is used for comparison with varieties grown for less than the full 12 year period.
(a) (Red Rustproof 1415-8 x Victoria-Richland) x Red Rustproof 1415-8.

Complete winter-killing of all varieties in field-plot tests occurred in 1930, 1933, 1935 and 1943. The same is true of the nursery tests, except that in 1943 differential winter-killing of varieties occurred in the nursery. All oats were destroyed by greenbugs in 1942 after differential winter-killing had occurred earlier in the winter. Loss of the entire crop in 1942 and of the fall-sown crop in 1943 has caused a serious delay in the development of new rust-resistant varieties. Five varieties included in the field-plot tests and eight included in the nursery tests are used as standards for comparison with varieties grown for periods less than the full 12 years.

Of the Red Rustproof strains grown the full 12-year period, New Nortex leads all others with an average yield of 4.4 bushels per acre more than Nortex in the field-plot tests and 3.4 bushels more in the nursery tests. Differences among the other Red Rustproof strains are small. During the period 1936 to 1941, large numbers of strains from a cross of Nortex and Victoria were tested in an attempt to secure an adapted strain resistant to crown (leaf) rust. As a group, these strains were disappointing because, although resistant to leaf rust, they were less productive than New Nortex and were lacking in hardiness. None was distributed commercially and only a few are listed in the table. Ranger and Rustler were developed from this same cross for South Texas conditions. They were tested at Denton from 1938 to 1945, but proved less productive than New Nortex and are more easily injured by low temperatures.

Strains recently developed from a cross of Red Rustproof and a strain of Victoria-Richland have been tested extensively. Yields of a few strains are shown for the period 1944 and 1946. These strains are resistant to crown rust and some races of stem rust but, in most instances, are lacking in winter-hardiness. Several have appeared of special promise from spring seeding.

Fulghum strains, such as Frazier, and most strains developed from crosses with Fulghum, such as Fultex, are less productive than New Nortex when fall-seeded in the Denton area. Wintok and the winter-type Fulghum strains, Fulwin and Tennex, are very hardy but are often seriously damaged by rusts in this area and are not recommended. Fulwin x Lee-Victoria (C.I. 4383) has produced yields much superior to its Fulwin parent and gives promise as a new rust-resistant hardy strain. Data on yield are given for the more promising of a large group of strains from Fulghum crosses tested from 1937 to 1941. Victorgrain, developed from the cross Fulgrain x Victoria, has been tested less extensively than Fultex, but appears to have no advantage over Fultex.

Table 6. Yields of spring-sown oat varieties and strains grown in replicated 1/44-acre field plots, 1933-46, inclusive, at Texas Substation No. 6, Denton, Texas

Number		Variety or strain	Yield of grain—bushels per acre													Average	
C. I.	T. S.		1933	1934	1935	1936	1937	1938	1939	1940	1941	1943	1944	1945	1946	For years grown	Standard varieties same period
2381	9234	Frazier*	77.2	71.5	75.1	41.6	64.8	48.7	67.3	64.9	39.2	35.7	49.1	28.2	45.8	54.5	57.6
2382	9235	Nortex*	88.0	67.9	76.7	65.9	60.3	54.7	54.3	82.3	43.0	20.2	34.3	44.1	57.9	57.7	57.6
3422	26155	New Nortex*	85.2	83.7	81.7	71.4	55.0	47.4	54.9	79.6	51.7	28.5	33.4	43.7	56.1	59.4	57.6
2150	9400	Ferguson 922*	83.7	81.2	81.6	69.9	53.2	50.4	55.7	79.3	53.7	21.2	27.6	42.4	54.8	58.0	57.6
2503	1118-69	Texas Red Rustproof*	87.2	81.7	77.2	74.2	50.4	47.4	55.9	80.8	46.7	26.3	33.9	45.7	52.2	58.4	57.6
		Total	421.3	386.0	392.3	323.0	283.7	248.6	288.1	386.9	234.3	131.9	178.3	204.1	266.8	.....	.....
		Average	84.3	77.2	78.5	64.6	56.7	49.7	57.6	77.4	46.9	26.4	35.7	40.8	53.4	57.6	57.6
.....	1415-12	Texas Red Rustproof	87.9	88.9	86.7	69.9	56.4	53.4	54.1	81.0	46.8	29.2	.....	.....	.....	65.4	61.9
.....	2805-39	Texas Red Rustproof	77.2	85.9	73.3	68.0	52.9	.....	.....	.....	.....	.....	.....	.....	.....	71.5	72.2
.....	2805-43	Texas Red Rustproof	86.1	86.9	82.1	68.5	53.8	.....	.....	.....	.....	.....	.....	.....	.....	75.5	72.2
.....	6217-43	Texas Red Rustproof	76.3	86.0	78.4	71.5	53.4	.....	.....	.....	.....	.....	.....	.....	.....	73.1	72.2
3417	27871	Ranger	.....	.....	.....	.....	.....	.....	.....	.....	36.4	31.0	.....	.....	.....	33.7	36.6
3733	.....	Rangler	.....	.....	.....	.....	.....	.....	.....	.....	.....	25.1	38.2	47.1	.....	36.8	34.3
3754	27908	Rustler	.....	.....	.....	.....	.....	.....	.....	79.8	33.4	27.1	.....	.....	.....	46.8	50.2
.....	.....	Nortex x Victa. 11-34-3	.....	.....	.....	.....	.....	47.6	.....	.....	.....	.....	.....	.....	.....	47.6	49.7
3534	.....	Nortex x Victa. 11-34-103	.....	.....	.....	.....	.....	49.4	49.0	.....	.....	.....	.....	.....	.....	49.2	53.7
3535	.....	Nortex x Victa. 11-35-41	.....	.....	.....	.....	.....	.....	49.5	78.8	39.7	.....	.....	.....	.....	56.0	60.6
.....	.....	R. R. P.[2] x Victa.-Rich. 29-39-304 (a)	.....	.....	.....	.....	.....	.....	.....	.....	.....	26.6	60.3	60.3	43.3	43.3	40.2
4603	.....	R. R. P.[2] x Victa.-Rich. 39-39-89	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	70.2	62.4	50.0	60.9	43.3
.....	.....	R. R. P.[2] x Victa.-Rich. 39-39-98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.4	42.0	50.7	47.1
.....	.....	R. R. P.[2] x Victa.-Rich. 39-39-100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	54.6	.....	54.6	40.8
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-146	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.4	.....	50.4	40.8
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-210	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.9	35.4	43.2	47.1
4604	.....	R. R. P.[2] x Victa.-Rich. 39-40-223	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48.6	45.2	46.9	47.1
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-231	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58.1	.....	58.1	40.8
4462	.....	R. R. P.[2] x Victa.-Rich. 39-40-250	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58.8	39.8	49.3	47.1
4661	.....	R. R. P.[2] x Victa.-Rich. 39-40-272	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52.0	47.2	49.6	47.1
3536	.....	Appler x Bond, 15-34-64	.....	.....	.....	.....	.....	49.0	50.8	39.1	.....	.....	.....	.....	.....	54.9	57.9
2909	18564	Norton No. 3	73.6	59.9	64.8	54.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	63.1	76.1
2498	15827	Fulghum (winter type)	85.7	52.3	56.3	55.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	69.9	76.1
3533	.....	Kanota x Victoria, 13-33-70	.....	.....	.....	.....	.....	47.6	.....	.....	.....	.....	.....	.....	.....	47.6	49.7
3531	28889	Fultex	.....	.....	.....	.....	.....	63.5	59.9	73.6	35.8	39.9	50.4	54.7	48.8	53.3	48.5
3529	.....	Fulghum x Victa. 12-34-13	.....	.....	.....	.....	.....	.....	60.5	75.0	.....	.....	.....	.....	.....	67.8	67.5
3692	.....	Victorgrain	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.3	53.3	40.6	51.1	43.3
3923	.....	DeSoto	.....	.....	.....	.....	.....	.....	.....	.....	.....	53.2	43.8	45.8	44.2	46.8	39.0
3392	.....	Letoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	56.8	24.5	47.4	.....	42.9	34.3
3855	.....	Stanton (Strain 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.9	21.5	41.1	46.2	39.9	39.0
4315	.....	Stanton Strain (43-33)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	52.1	.....	52.1	40.8
4383	.....	Fulwin x Lee-Victa. 3770	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.4	53.0	43.0	48.5	43.3
.....	.....	Fulwin x Lee-Victa. 3832	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.1	42.9	.....	39.5	38.2

*Standard varieties, mean of which is used for comparison with other varieties grown for shorter periods.
(a) (Red Rustproof 1415-8 x Victoria-Richland) x Red Rustproof 1415-8.

The Lee x Victoria strains have been tested for relatively short periods. In comparison with standard varieties, several have good records, DeSoto and Stanton being the most promising in yield and general agronomic characters. The tender varieties, Osage and Camellia, should not be fall-sown in this region.

Yields of spring-sown oats: Data on yields of spring-sown oats at Denton (Tables 6 and 7) are presented only for the more recent period, 1933 to 1946, inclusive. The crop was destroyed by greenbugs in 1942, and no data were obtained in 1939 owing to a spring freeze. Five varieties in the variety test and 8 varieties in the nursery test are used as standards for comparison with strains grown less than the full period of years.

Differences in yield are small among the Red Rustproof type strains tested. In the variety test, New Nortex has averaged about 2 bushels more than Nortex, but in the nursery there is no difference between the two varieties. As with the fall-sown oat tests, a large number of Nortex x Victoria strains were tested from 1936 to 1941. Although resistant to crown rust, none was of sufficient promise to name and distribute commercially. The Ranger and Rustler varieties, developed for South Texas from the same cross, are less productive at Denton from spring-seeding than the standard varieties. Strains from the Red Rustproof[2] x Victoria-Richland cross showed unusual promise in 1944 and 1945 when their resistance to crown and stem rust was an important factor in yield. Some of these strains may be valuable for spring varieties in North-central Texas, or may be valuable farther south where hardiness is less important.

The winter-type Fulghum varieties, such as Fulwin and Tennex, yield low from spring-seeding in this area because of rust damage. Also, the older Fulghum strains, such as Coker Fulghum No. 4, Kanota and Frazier, though often rust-escaping, are less productive from spring-seeding than New Nortex in the Denton tests. Rust-resistant strains developed from crosses with Fulghum appear the most promising now available for the Denton area, although susceptibility to Helminthosporium blight may prevent their widespread use. Fultex has averaged 4.8 bushels more than the standard varieties in 8 years of field-plot tests, and 4.7 bushels more in the nursery test. Victorgrain has been tested 4 years, averaging approximately the same as Fultex. Many new strains developed from a cross of Iogold-Bond x Fultex are now being tested in the replicated nursery. In 1945 and 1946, strains from this cross made outstanding yields compared with the standard varieties.

Table 7. Yields of spring-sown oat varieties and strains grown in replicated nursery plots, 1933-1946, inclusive, at Texas Substation No. 6, Denton, Texas

Number		Variety or strain	Yield of grain—bushels per acre												Average	
C. I.	T. S.		1933	1934	1935	1936	1937	1938	1940	1941	1943	1944	1945	1946	For years grown	Standard varieties same period
2381	9234	Frazier*	61.6	51.3	68.4	54.4	66.9	72.6	70.4	32.7	43.9	36.4	25.9	43.9	52.4	54.8
2382	9235	Nortex*	64.6	53.6	65.7	72.2	71.2	63.3	85.9	29.4	36.0	33.8	41.9	51.7	55.8	54.8
3422	26155	New Nortex*	66.2	49.9	61.2	58.4	79.6	57.5	80.5	34.6	42.9	36.8	43.7	55.2	55.5	54.8
2150	9400	Ferguson 922*	61.8	51.9	64.0	71.0	57.6	52.3	97.0	31.8	37.6	37.1	41.7	55.6	54.9	54.8
2503	1118–69	Texas Red Rustproof*	68.4	52.6	60.2	69.4	61.5	69.4	84.8	33.0	37.5	29.9	40.2	46.8	54.5	54.8
.....	6217–43	Texas Red Rustproof*	64.3	57.2	63.0	63.4	57.3	65.2	85.7	34.6	39.4	37.7	42.8	54.3	55.4	54.8
.....	2805–43	Texas Red Rustproof*	63.8	53.8	62.2	75.0	57.2	61.1	85.1	31.4	36.4	35.4	46.6	53.2	55.1	54.8
		Total	450.7	370.3	444.7	463.8	451.3	441.1	589.4	227.5	273.7	247.1	282.8	360.7	.....	.....
		Average	64.4	52.9	63.5	66.3	64.5	63.0	84.2	32.5	39.1	35.3	40.4	51.5	54.5	54.8
.....	1415–12	Texas Red Rustproof	68.0	53.0	65.6	63.4	57.9	65.4	89.0	32.4	36.1	31.8	45.0	.....	55.2	55.1
3417	27871	Ranger	.....	.....	.....	.....	.....	61.6	87.0	26.7	44.1	32.9	.....	.....	50.5	50.8
3733	.....	Rangler	.....	.....	.....	.....	.....	.....	.....	.....	37.8	40.8	42.3	.....	40.3	38.3
3754	27908	Rustler	.....	.....	.....	.....	.....	63.8	86.9	26.8	25.1	55.0	.....	.....	51.5	50.8
.....	.....	Nortex x Victa. 11-33-78	.....	.....	.....	60.2	54.8	69.5	82.7	.....	.....	.....	.....	.....	66.8	69.5
3534	.....	Nortex x Victa. 11-34-103	.....	.....	.....	.....	54.7	71.6	82.0	23.2	.....	.....	.....	.....	57.9	61.0
.....	.....	Nortex x Victa. 11-34-193	.....	.....	.....	.....	49.7	70.2	76.4	.....	.....	.....	.....	.....	65.4	70.6
3535	.....	Nortex x Victa. 11-35-41	.....	.....	.....	.....	.....	71.6	89.8	30.4	.....	.....	.....	.....	60.9	59.9
.....	.....	Nortex x Victa. 11-35-171	.....	.....	.....	.....	.....	73.7	84.0	28.4	.....	.....	.....	.....	62.0	59.9
1815	.....	Appler Rustproof	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.5	51.9	47.7	45.9
3536	.....	Appler x Bond, 15-34-64	.....	.....	.....	.....	50.8	62.6	81.8	27.6	.....	.....	.....	.....	55.7	61.0
.....	.....	Appler x Bond, 15-34-63	.....	.....	.....	.....	52.8	61.4	83.3	31.0	.....	.....	.....	.....	57.1	61.0
.....	.....	R. R. P.[2] x Victa.-Rich. 29-39-304 (a)	.....	.....	.....	.....	.....	.....	.....	.....	.....	69.7	.....	41.2	55.4	43.4
.....	.....	R. R. P.[2] x Victa.-Rich. 29-39-308	.....	.....	.....	.....	.....	.....	.....	.....	30.3	60.3	61.4	.....	50.7	38.3
.....	.....	R. R. P.[2] x Victa.-Rich. 39-39-98	.....	.....	.....	.....	.....	.....	.....	.....	.....	69.1	.....	43.6	56.4	43.4
.....	.....	R. R. P.[2] x Vict.-Rich. 39-39-100	.....	.....	.....	.....	.....	.....	.....	.....	29.4	69.8	.....	.....	49.6	37.2
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-95	.....	.....	.....	.....	.....	.....	.....	.....	.....	53.7	51.2	.....	52.4	37.8
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-201	.....	.....	.....	.....	.....	.....	.....	.....	.....	52.6	49.6	48.8	50.0	42.4
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-219	.....	.....	.....	.....	.....	.....	.....	.....	.....	78.6	.....	.....	78.6	35.3
4604	.....	R. R. P.[2] x Victa.-Rich. 39-40-223	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.4	.....	44.4	40.4	43.4
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-227	.....	.....	.....	.....	.....	.....	.....	.....	.....	67.6	54.7	40.4	54.2	42.4
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-243	.....	.....	.....	.....	.....	.....	.....	.....	.....	36.5	56.1	.....	46.2	37.8
4462	.....	R. R. P.[2] x Victa.-Rich. 39-40-250	.....	.....	.....	.....	.....	.....	.....	.....	.....	82.9	.....	39.7	61.3	43.4
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-290	.....	.....	.....	.....	.....	.....	.....	.....	.....	62.3	.....	.....	62.3	35.3
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-380	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.2	45.4	52.3	45.9
.....	.....	R. R. P.[2] x Victa.-Rich. 39-40-426	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.5	44.5	.....	47.5	37.8
4662	.....	R. R. P.[2] x Victa.-Rich. 39-40-427	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.7	44.4	47.0	45.9
2498	15827	Fulghum (winter type)	64.7	28.7	30.0	62.8	.....	.....	.....	.....	.....	.....	.....	.....	46.6	61.8
2500	20446	Fulghum (winter type)	68.7	12.7	15.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	33.1	60.3

3168	.....	Fulwin	.....	.....	.....	.....	.....	.....	.....	11.0	.....	17.4	.....	.....	14.2	33.9
3169	.....	Tennex	.....	.....	.....	.....	.....	.....	.....	12.0	45.6	.....	.....	.....	28.8	35.8
3424	.....	Wintok	.....	.....	.....	.....	.....	.....	79.8	5.0	.....	2.8	.....	.....	29.2	50.7
708	20482	Fulghum	54.9	46.1	56.5	60.5	67.2	77.6	73.2	32.7	43.4	43.1	25.0	48.6	52.4	54.8
839	.....	Kanota	44.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.9	63.8
.....	18565	Coker Fulghum No. 4	55.3	51.4	58.2	52.8	.....	.....	.....	.....	.....	.....	.....	.....	54.5	61.8
2909	18564	Norton No. 4	57.5	40.0	48.8	60.4	.....	.....	.....	.....	.....	.....	.....	.....	51.7	61.8
3531	28889	Fultex	.....	.....	.....	.....	55.6	92.9	78.6	34.0	44.9	46.5	52.7	43.1	56.0	51.3
3528	.....	Fulghum x Victa. 12-33-90	.....	.....	.....	65.6	68.3	92.0	72.8	34.6	47.7	.....	.....	.....	63.5	58.3
3529	.....	Fulghum x Victa. 12-34-13	.....	.....	.....	.....	65.4	84.2	81.6	39.2	.....	.....	.....	.....	67.6	61.0
3533	.....	Kanota x Victa. 13-33-70	.....	.....	.....	69.6	67.2	67.1	91.8	28.8	.....	.....	.....	.....	64.9	62.1
.....	.....	Kanota x Victa. 13-34-13	.....	.....	.....	.....	52.4	70.1	82.3	30.5	.....	.....	.....	.....	58.8	61.0
3692	.....	Victorgrain	.....	.....	.....	.....	.....	.....	.....	26.2	48.4	43.2	53.4	45.2	43.3	39.8
2401	18562	Victoria	67.9	46.6	61.0	55.6	.....	.....	.....	.....	.....	.....	.....	.....	57.8	61.8
2733	20451	Bond	30.0	42.7	52.0	51.4	.....	.....	.....	.....	.....	.....	.....	.....	44.0	61.8
2820	20469	Columbia	58.6	35.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.1	58.6
2054	20456	Brunker	56.2	40.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48.4	58.6
2378	.....	Carleton	39.6	8.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24.0	58.6
2766	.....	Alber	62.5	35.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.2	58.6
3384	.....	Lega	.....	.....	.....	.....	.....	.....	.....	.....	53.5	39.1	.....	.....	46.3	37.2
3392	.....	Letoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	25.2	.....	.....	25.2	35.3
3855	.....	Stanton (Strain 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	23.2	40.2	50.2	37.9	42.4
4315	.....	Stanton (Strain 43-33)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.6	.....	47.6	40.4
3923	.....	DeSoto	.....	.....	.....	.....	.....	.....	.....	.....	.....	38.4	51.1	48.3	45.9	42.4
4079	.....	Camillia	.....	.....	.....	.....	.....	.....	.....	.....	.....	35.6	.....	.....	35.6	35.3
3991	.....	Osage	.....	.....	.....	.....	.....	.....	.....	.....	.....	73.4	57.2	33.7	54.8	42.4
3989	.....	Ventura	.....	.....	.....	.....	.....	.....	.....	.....	.....	74.7	57.5	38.3	56.8	42.4
4141	.....	Neosho	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.8	50.7	44.0	48.2	42.4
3971	.....	Clinton	.....	.....	.....	.....	.....	.....	.....	.....	.....	46.9	42.9	43.2	44.3	42.4
3502	.....	Tama	.....	.....	.....	.....	.....	.....	.....	.....	.....	54.1	50.8	36.4	47.1	42.4
3314	.....	Cedar	.....	.....	.....	.....	.....	.....	.....	.....	.....	53.2	46.7	.....	50.0	37.8
3611	.....	Vicland	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56.2	37.8	46.0	45.9
3305	.....	Boone	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.5	.....	.....	47.5	35.3
.....	.....	Fultex x Iogold-Bond, 46-42-304	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58.3	47.0	52.6	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-2234	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.8	45.0	52.4	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-2870	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.0	.....	49.0	40.4
.....	.....	Fultex x Iogold-Bond, 46-42-3027	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.5	40.4	45.0	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3028	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	62.2	48.4	55.3	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3035	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.7	44.9	52.3	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3070	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	57.7	43.6	50.6	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3110	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.8	33.0	46.4	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3113	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	64.3	34.3	49.3	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3115	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56.6	38.1	47.4	45.9
.....	.....	Fultex x Iogold-Bond, 46-42-3132	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65.0	39.5	52.2	45.9

*Standard varieties, mean of which is used for comparison with varieties grown for shorter periods.

(a) (Red Rustproof 1415-8 x Victoria-Richland) x Red Rustproof 1415-8.

The Lee-Victoria strains, Letoria, Lelina, Stanton and DeSoto, are somewhat late maturing from spring-seeding at Denton, and only DeSoto has exceeded the yield of the standard varieties. It appears probable that if any of these strains find a place in Texas it will be as fall-seeded varieties.

The new rust-resistant varieties, Osage, Ventura and Neosho, and the Corn Belt rust-resistant white or yellow grained varieties, Vicland, Tama, Cedar, Boone and Clinton, have yielded well in comparison with standard varieties during the past three wet seasons when rust was an important factor in yield. Further testing in more normal seasons is necessary to establish their value for this area. All are highly susceptible to low temperatures and should never be fall-seeded in Region 3. All, except Clinton, are highly susceptible to Helminthosporium blight which has caused increasing losses in recent years in this area.

Variety Trials at Greenville*

Small grain variety trials have been conducted at the U. S. Cotton Field Station, Greenville, Texas, since 1936. Greenville is located in the northeast part of Region 3, some 50 miles northeast of Dallas. Cotton is the major cash crop, although in recent years the acreages devoted to the small grains have increased.

During the first 5 seasons, the tests were grown in replicated 1/55-acre field plots, but during the last 6 seasons the tests have been made in replicated nursery plots. All have been fall-seeded. During the 11-year period, only three varieties have been grown continuously. The difference in yields of the three varieties are small, although New Nortex leads by a small margin. Many strains tested for short periods are not included in the data shown. A considerable number of strains from the Nortex x Victoria cross have been tested but none was of sufficient value for distribution. Ranger and Rustler have yielded less than the Red Rustproof strains. Several Red Rustproof[2] x Victoria-Richland strains, resistant to crown rust and stem rust, were tested in 1945 and 1946 and appear to be of promise.

The early-maturing Fulghum type varieties have been damaged by birds several seasons, so yield data for these are neither entirely satisfactory nor comparable. The Fulghum (winter type) strains, Fulwin and Tennex, are inferior to Red Rustproof for this area, producing lower yields, except in 1943 when winter-killing oc-

*Small grain tests conducted in cooperation with D. R. Hooton, superintendent.

Cotton Field Station, Greenville, Texas

Number C. I.	Number T. S.	Variety or strain	Yield of grain—bushels per acre 1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	Average For years grown	Average Standard varieties same period
2382	9235	Nortex*	42.6	47.4	44.9	45.4	49.2	61.8	31.4	6.0	68.6	45.4	111.1	50.3	51.4
3422	26155	New Nortex*	49.8	48.1	46.8	51.0	47.5	67.0	32.4	13.0	69.4	40.9	109.3	52.3	51.4
2150	9400	Ferguson 922*	43.5	46.4	46.4	49.6	54.7	63.5	34.6	7.2	68.8	40.4	113.2	51.7	51.4
		Total	135.9	141.9	138.1	146.0	151.4	192.3	98.4	26.2	206.8	126.7	333.6		
		Average	45.3	47.3	46.0	48.7	50.5	64.1	32.8	8.7	68.9	42.2	111.2	51.4	51.4
	1415–12	Texas Red Rustproof	47.0	50.1	49.1	50.0	51.0	73.0	32.2	9.9				45.3	42.9
2503	1118–69	Texas Red Rustproof	48.2	45.4	43.3	45.8								45.7	46.8
	2805–39	Texas Red Rustproof	43.7	48.1										45.9	46.3
3417	27871	Ranger						55.1	20.6	7.4	51.8			33.7	43.6
3754	27908	Rustler						65.4	20.0	4.9				30.1	35.2
3733		Rangler							32.4	7.2	43.7			38.4	38.2
3434		Nortex x Victa. 11-34-103				45.9								45.9	48.7
3535		Nortex x Victa. 11-35-41					45.9	78.3	17.8					47.3	49.1
		Nortex x Victa. 11-35-171						64.3						64.3	64.1
		Nortex x Victa. M19-35						64.0	25.7					44.8	48.4
		R. R. P.[2] x Victa.-Rich. 39-39-89 (a)										39.0	85.0	62.0	97.4
		R. R. P.[2] x Victa.-Rich. 39-40-201											101.2	101.2	111.2
		R. R. P.[2] x Victa.-Rich. 39-40-210										43.8	96.8	70.3	97.4
		R. R. P.[2] x Victa.-Rich. 39-40-223										34.6	87.8	61.2	97.4
		R. R. P.[2] x Victa.-Rich. 39-40-231										42.9		42.9	42.2
		R. R. P.[2] x Victa.-Rich. 39-40-250										42.2	101.8	72.0	97.4
		R. R. P.[2] x Victa.-Rich. 39-40-272										38.4	95.6	67.0	97.4
		R. R. P.[2] x Victa.-Rich. 39-40-427											111.0	111.0	111.2
3536		Appler x Bond				45.8	44.0	71.3	16.8					44.5	49.0
2381	9234	Frazier	30.1	33.8	12.5	18.6	18.2	60.9	21.4	2.3		11.8		23.3	42.8
3327		Fulton						60.2	16.8					38.6	48.4
2498	15827	Fulghum (winter type)	34.5	34.4										34.4	46.3
3168		Fulwin						45.4	17.2	28.2	68.9	18.7	58.5	39.5	54.7
3169		Tennex						53.4	17.2	27.3				32.6	35.2
3531	28889	Fultex				36.9	26.3	62.5	16.2	10.8		29.1	82.9	37.8	51.2
4383		Fulwin x Lee-Vict. 3770										37.8	110.1	74.0	76.7
3529		Fulghum x Victoria, 12-34-13			29.0	34.5	24.2							29.3	48.4
3692		Victorgrain						75.0	25.4	9.7		28.0	88.7	45.4	51.8
3693		Fulgrain Strain 4						54.8	18.6	1.9				25.1	35.2
3404		Lelina							22.5	12.4				17.4	20.8
3392		Letoria								30.1	70.7	39.7		46.8	40.0
3855		Stanton Strain 1								13.9	66.9	34.3	102.7	54.4	57.8
4315		Stanton Strain 43-33										35.6	104.3	70.0	76.7
3923		DeSoto								4.2	60.6	42.8	106.9	53.6	57.8
4206		Traveler 1										28.2	98.2	63.2	76.7

*Standard varieties, mean of which is used for comparison with other varieties grown for shorter periods.
(a) (Red Rustproof 1415-8 x Victoria-Richland) x Red Rustproof 1415-8

curred. Letoria, Stanton and DeSoto have been tested for only short periods. Because of its hardiness, Letoria produced high yields in 1943. On the average, these strains do not, from data available, show any superiority over Red Rustproof strains.

Variety Trials at Iowa Park*

Small grain variety tests have been conducted at the Iowa Park station since 1932. Iowa Park is located in the Wichita River Valley (Region 2) about 12 miles west of Wichita Falls, Texas. The average precipitation is 31.5 inches, but additional moisture is supplied as necessary through irrigation from Lake Kemp. The principal crops of the region are small grains, cotton and grain sorghum. Extensive areas are devoted to ranching.

All small grain tests at Iowa Park are fall-sown. From 1932 to 1941, the tests were planted in replicated 1/44-acre field plots, but since 1941 the tests have been planted in replicated nursery plots. Winter-killing of oats occurred in 1933 and 1935, while differential killing of varieties occurred in 1943. In 1942, all small grains were destroyed by greenbugs. Only the varieties Frazier and New Nortex have been grown the full 11 years in which yields have been obtained. They are used as standard varieties with which to compare other varieties grown for shorter periods.

Average yields reported are higher than would be expected under dryland farming in the area. New Nortex has yielded approximately 20 bushels per acre more than Frazier for the 11 years tested. Differences in yield among the Red Rustproof strains are probably within the limits of error. Ranger and Rustler and other Nortex x Victoria strains, were of little promise for the area as indicated in these tests. The winter-hardy varieties, Tennex, Fulwin and Wintok, have not yielded as well as New Nortex at this station. However, they are more winter-hardy and may survive from fall-seeding more often. They have produced high yields under dryland conditions at Chillicothe, Texas, and at Lawton, Okla. Fulwin x Lee-Victoria (C.L. 4383) appears to be a promising new rust-resistant hardy strain from limited tests in this area. Fultex has been one of the leading varieties in yield at Iowa Park and Chillicothe, Texas, and Lawton, Okla., in the Rolling Plains area; it has also given satisfactory results in commercial production. The Lee x Victoria strains Letoria, Stanton and DeSoto appear of some promise based on 2-year tests.

*Tests conducted in cooperation with L. E. Brooks, superintendent.

Substation No. 16, Iowa Park, Texas

Number		Variety or strain	Yield of grain—bushels per acre												Average	
C. I.	T. S.		1932	1934	1936	1937	1938	1939	1940	1941	1943	1944	1945	1946	For years grown	Standard varieties same period
2381	9234	Frazier*	84.2	77.6	62.8	36.0	29.2	88.9	31.4	32.7	5.1	47.8	70.0	50.8	51.4	62.0
3422	26155	New Nortex*	110.3	108.8	84.4	47.0	38.2	112.6	48.0	47.0	24.6	74.2	96.0	81.4	72.7	62.0
		Total	194.5	186.4	147.2	83.0	67.4	201.5	79.4	79.7	29.7	122.0	166.0	132.2	.....	.....
		Average	97.2	93.2	73.6	41.5	33.7	100.8	39.7	39.8	14.8	61.0	83.0	66.1	62.0	62.0
2382	9235	Nortex	108.4	94.0	77.7	46.0	34.4	.....	.....	45.3	12.9	70.6	100.2	62.7	65.2	60.4
2503	1118–69	Texas Red Rustproof	102.2	105.9	82.5	50.0	35.3	.....	.....	.....	.....	.....	.....	.....	75.2	67.8
.....	1415–12	Texas Red Rustproof	.....	.....	.....	45.3	35.6	114.4	51.2	42.9	21.9	.....	.....	.....	51.9	45.0
2150	9400	Ferguson 922	.....	.....	.....	.....	.....	117.8	46.6	48.4	10.0	61.6	99.2	66.5	64.3	57.9
3417	27871	Ranger	.....	.....	.....	.....	.....	.....	.....	33.1	12.2	68.8	.....	.....	38.1	38.6
3754	27908	Rustler	.....	.....	.....	.....	.....	.....	.....	31.8	2.3	.....	.....	.....	17.0	27.4
3733	.....	Rangler	.....	.....	.....	.....	.....	.....	.....	.....	6.8	63.5	99.2	.....	56.5	52.9
3535	.....	Nortex x Victa. 11-35-41	.....	.....	.....	.....	.....	.....	.....	33.9	.....	.....	.....	.....	33.9	39.8
.....	.....	Nortex x Victa. 11-35-177	.....	.....	.....	.....	.....	.....	.....	31.2	.....	.....	.....	.....	31.2	39.8
.....	.....	Nortex x Victa. 11-36-41	.....	.....	.....	.....	.....	.....	.....	35.8	.....	.....	.....	.....	35.8	39.8
.....	.....	Nortex x Victa. M19-35	.....	.....	.....	.....	.....	.....	.....	28.2	.....	.....	.....	.....	28.2	39.8
3717	.....	R. R. P.[2] x Victa.-Rich. (a)	.....	.....	.....	.....	.....	.....	.....	.....	2.3	.....	.....	.....	2.3	14.8
3720	.....	R. R. P.[2] x Victa.-Rich	.....	.....	.....	.....	.....	.....	.....	.....	11.4	.....	.....	.....	11.4	14.8
3725	.....	R. R. P.[2] x Victa.-Rich	.....	.....	.....	.....	.....	.....	.....	.....	3.0	.....	.....	.....	3.0	14.8
3536	.....	Appler x Bond, 15-34-64	.....	.....	.....	.....	.....	.....	.....	38.5	.....	.....	.....	.....	38.5	39.8
2498	15827	Fulghum (winter type)	82.0	84.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	83.3	95.2
3168	.....	Fulwin	.....	.....	.....	.....	.....	.....	.....	11.5	24.0	66.4	70.4	70.8	48.6	53.0
3169	.....	Tennex	.....	.....	.....	.....	.....	.....	.....	15.6	22.9	59.4	65.8	.....	40.9	49.7
3170	.....	Forkdeer	.....	.....	.....	.....	.....	.....	.....	.....	22.9	.....	.....	.....	22.9	14.8
3424	.....	Wintok	.....	.....	.....	.....	.....	.....	.....	.....	19.0	65.8	75.2	93.7	63.4	56.2
3327	.....	Fulton	.....	.....	.....	.....	.....	.....	.....	27.0	5.5	.....	.....	.....	16.2	27.4
839	7173	Kanota	.....	.....	.....	.....	.....	.....	.....	29.7	.....	.....	.....	.....	29.7	39.8
.....	.....	Kanota x Victa. 13-34-13	.....	.....	.....	.....	.....	.....	.....	32.0	.....	.....	.....	.....	32.0	39.8
3531	28889	Fultex	.....	.....	.....	.....	.....	101.3	42.2	40.8	17.3	60.6	84.4	71.8	59.8	57.9
3692	.....	Victorgrain	.....	.....	.....	.....	.....	.....	.....	34.3	10.3	53.8	81.4	85.0	53.0	53.0
3693	.....	Fulgrain Strain 4	.....	.....	.....	.....	.....	.....	.....	30.6	7.2	.....	.....	.....	18.9	27.4
3404	.....	Lelina	.....	.....	.....	.....	.....	.....	.....	.....	21.7	.....	.....	.....	21.7	14.8
3392	.....	Letoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	78.3	97.0	83.8	86.4	70.0
3855	.....	Stanton Strain 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	66.0	84.0	86.5	78.8	70.0
4315	.....	Stanton Strain 43-33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	97.6	75.2	86.4	74.6
4206	.....	Traveler 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	95.4	.....	95.4	83.0
4383	.....	Fulwin x Lee-Victa. 3770	.....	.....	.....	.....	.....	.....	.....	.....	.....	70.7	85.6	85.4	80.6	70.0
.....	.....	Fulwin x Lee-Victa. 3832	.....	.....	.....	.....	.....	.....	.....	.....	.....	70.4	88.2	.....	79.3	74.0
.....	.....	Fulwin x Lee-Victa. 3818	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	88.0	.....	88.0	83.0
3923	.....	DeSoto	.....	.....	.....	.....	.....	.....	.....	.....	27.0	65.6	84.2	.....	58.9	52.9

*Standard varieties, mean of which is used for comparison with other varieties.
(a) (Red Rustproof x Victoria-Richland) x Red Rustproof 1415-8.

Variety Trials at Chillicothe*

The Chillicothe station is located in the northern part of Region 2 in the Rolling Plains area of Central-west Texas. The mean annual precipitation is 24.4 inches. Principal crops in the area are grain sorghum, cotton and wheat. Extensive areas are devoted to ranching.

From 1919 to 1928, inclusive, variety tests of spring-sown oats were conducted in 1/44-acre field plots. Complete failure of oats because of drouth and other hazards occurred in 1922, 1923 and 1925. Five varieties were grown the full 10-year period, and of these, Frazier produced the highest average yield, 21 bushels per acre. Nortex, grown during the same period, yielded about 2 bushels less than Frazier. At the end of this period, it was concluded that spring-sown oats were not a profitable crop and the test was abandoned.

Because of the introduction of more winter-hardy strains of oats and the interest in fall-sown oats, variety tests were again inaugurated in 1942 on a nursery-plot basis. The 1942 crop was destroyed by greenbugs. Data for the 1943, 1944, 1945 and 1946 crops are presented in Table 11. Differential winter-killing of varieties occurred in 1943 and 1944, causing wide fluctuations in yields. No adequate explanation is known for the wide fluctuations in yields in 1945. Five varieties, grown all three seasons, are used as standard varieties for comparison with varieties grown for shorter periods. Of these five, Fulwin leads in yield because of its winter-hardiness. The other winter-hardy varieties, Tennex, Forkedeer and Wintok, also yielded well, which agrees with results obtained at the nearby Lawton, Okla., station for longer periods.

The Fulwin x Lee-Victoria strains, especially C.I. 4383, appear promising on the basis of tests in two seasons. The Lee-Victoria strains, Letoria and Stanton, which are slightly more winter-hardy than the Red Rustproof strains, yielded well in the past two seasons but DeSoto was less promising at Chillicothe.

The Red Rustproof strains yielded less than the more winter-hardy varieties. Strains developed from hybrids with Red Rustproof such as Ranger, Rustler, Rangler and the Red Rustproof[2] x Victoria-Richland strains, are too susceptible to low temperatures to be grown from fall-seeding in this area. Fultex has produced exceptionally high yields at Chillicothe, and has survived the winters better than Red Rustproof strains. This is in agreement with its record at Iowa Park, Texas, and at Lawton, Okla. Victorgrain has averaged nearly 10 bushels per acre less than Fultex.

*Tests conducted in cooperation with J. Roy Quinby, superintendent.

Table 10. Yields of spring-sown oat varieties and strains grown in replicated field plots, 1919-1928, inclusive, Texas Substation No. 12, Chillicothe, Texas

Number		Variety or strain	Yield of grain—bushels per Acre										Average	
C. I.	T. S.		1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	For years grown	Standard varieties same period
2382	9235	Nortex*	36.3	56.5	13.0	0	0	22.9	0	49.8	8.8	6.7	19.4	19.1
.....	1401	Appler Rustproof*	27.5	45.0	11.5	0	0	30.9	0	50.2	8.4	7.0	18.1	19.1
.....	1415	Texas Red Rustproof*	30.5	44.2	22.5	0	0	28.1	0	45.0	10.4	6.9	18.8	19.1
.....	775	Alabama Red Rustproof*	34.2	50.5	13.0	0	0	27.3	0	59.0	11.4	8.0	20.3	19.1
		Total	128.5	196.2	60.0	0	0	109.2	0	204.0	39.0	28.6	.....	.....
		Average	32.1	49.0	15.0	0	0	27.3	0	51.0	9.8	7.2	19.1	19.1
.....	776	Texas Red Rustproof	40.2	52.5	9.2	0	0	.....	.....	.....	.....	.....	20.4	19.2
.....	986	McReynolds Red Rustproof	.....	.....	.....	.....	.....	26.3	0	50.3	10.6	.....	21.8	29.4
.....	985	Ferguson 71	.....	.....	.....	.....	.....	23.5	0	54.0	12.1	7.5	19.4	19.0
.....	1414	Bicknell	22.3	45.0	11.0	0	0	.....	.....	.....	.....	.....	15.9	19.2
.....	1409	Culberson	27.0	58.5	23.0	.....	.....	.....	.....	.....	.....	.....	34.8	32.0
.....	782	Fulghum	.....	.....	.....	.....	.....	24.5	0	60.2	12.0	4.5	20.2	19.0
.....	.....	Frazier, 765-16-1	36.5	66.8	9.0	0	0	25.5	0	55.4	13.0	3.5	21.0	19.1
839	7173	Kanota	.....	.....	.....	.....	.....	28.4	0	60.6	13.7	4.4	21.4	19.0

*Standard varieties, mean of which is used for comparison with varieties grown for shorter periods.

Table 11. Yields of fall-sown oat varieties and strains grown in replicated nursery plots, 1942-1946, inclusive, at Texas Substation No. 12, Chillicothe, Texas

Number		Variety or strain	Yield of grain—bushels per acre				Average for years grown	Average of standard varieties same period
C. I.	T. S.		1943	1944	1945	1946		
2382	9235	Nortex*	61.2	13.6	53.6	37.8	41.6	45.6
3422	26155	New Nortex*	75.0	21.6	64.2	44.2	51.2	45.6
2150	9400	Ferguson 922*	59.6	29.5	70.2	27.2	46.6	45.6
3168	.....	Fulwin*	72.3	31.4	73.2	32.7	52.4	45.6
2381	9234	Frazier*	63.4	27.6	34.4	19.6	36.2	45.6
		Total	331.5	123.7	295.6	161.5	.....	.....
		Average	66.3	24.7	59.1	32.3	45.6	45.6
.....	1415–12	Texas Red Rustproof	60.0	.....	.....	.....	60.0	66.3
3417	27871	Ranger	48.9	23.1	.....	.....	36.0	45.5
3754	27908	Rustler	32.7	.....	.....	.....	32.7	66.3
3733	.....	Rangler	42.1	37.0	56.1	.....	45.1	50.0
3717	.....	Red Rustproof[2] x Victoria-Richland (a)	26.3	.....	.....	.....	26.3	66.3
3720	.....	Red Rustproof[2] x Victoria-Richland (a)	56.6	.....	.....	.....	56.6	66.3
3725	.....	Red Rustproof[2] x Victoria-Richland (a)	43.8	.....	.....	.....	43.8	66.3
3424	.....	Wintok	74.5	37.0	84.7	36.1	58.0	45.6
3170	.....	Forkedeer	46.3	.....	.....	.....	46.3	66.3
3169	.....	Tennex	.....	38.2	80.0	.....	59.1	41.9
4383	.....	Fulwin x Lee-Victoria, Sel. 3770	.....	33.3	83.4	33.6	50.1	38.7
.....	.....	Fulwin x Lee-Victoria, Sel. 3832	.....	31.0	68.9	.....	50.0	41.9
.....	.....	Fulwin x Lee-Victoria, Sel. 3818	.....	.....	80.0	.....	80.0	59.1
4206	.....	Traveler	.....	.....	83.8	.....	83.8	59.1
3392	.....	Letoria	.....	29.9	57.9	42.5	43.4	38.7
3855	.....	Stanton Strain 1	.....	35.9	103.0	43.4	60.8	38.7
4315	.....	Stanton Strain 43-33	.....	.....	83.8	43.8	63.8	45.7
3923	.....	DeSoto	61.8	18.2	64.2	.....	48.1	50.0
3404	.....	Lelina	63.8	.....	.....	.....	63.8	66.3
3692	.....	Victorgrain	60.4	29.1	91.9	32.7	53.5	45.6
3693	.....	Fulgrain Strain 4	51.9	.....	.....	.....	51.9	66.3
3531	28889	Fultex	71.1	32.9	111.9	38.7	63.6	45.6
3327	.....	Fulton	16.6	.....	.....	.....	16.6	66.3

*Standard varieties, mean of which is used for comparison with varieties grown for shorter periods.
(a) (Red Rustproof 1415-8 x Victoria-Richland) x Red Rustproof 1415-8.

Variety Trials at Amarillo*

Tests of fall-sown oats were started at the Amarillo Conservation Experiment Station in 1942 but had to be discontinued after the one season because of reduction of personnel during World War II. Amarillo is located in the Texas Panhandle, Region 1 of Figure 2. The elevation is 3,657 feet and the mean annual precipitation is 21.01 inches. Principal crops in this area are wheat and grain sorghums. Extensive areas are devoted to ranching.

Table 12. Yields of fall-sown oat varieties grown in replicated nursery tests at the Amarillo Conservation Experiment Station, Amarillo, Texas, 1942

Number		Variety	Grain yield bushels per acre
C. I.	T. S.		
3527	.....	Woodward composit	40.0
3170	.....	Forkedeer	46.8
3169	.....	Tennex	47.0
3168	.....	Fulwin	41.6
3531	28889	Fultex	43.5
2499	.....	Fulghum (winter type)	50.4

The 1942 season was a favorable crop season. All varieties of oats survived the winter and, had it not been for rust damage in the spring, oats would have produced very high yields. Crown (leaf) rust was an important factor in yield, which is unusual in that area. The highest yields were produced by Fulghum (winter type, C.I. 2499) and Tennex, although differences in yield were small. It seems probable from these data and observations under limited commercial production that the very hardy varieties, such as Wintok, Tennex and Fulwin, may be used for fall-seeding in the High Plains area. Winter-killing would occur rather frequently but, because of their value for fall pasture, and for those who value oats as a bundle feed or for grain for breeding stock, the risk might be worthwhile. No recent tests have been made from spring-seeding, but commercial production in favorable seasons consists largely of the varieties Kanota, Fulton and Red Rustproof strains.

Variety Trials at Temple†

The Temple station is located in the central Blacklands 3 miles south of Temple, Texas. The mean annual precipitation is 35.2 inches. The principal crops in the area are cotton, corn, grain sorghums and oats.

*Tests conducted by David A. Reid, agronomist. Cooperative project between the Texas Agricultural Experiment Station and the Soil Conservation Service, U. S. Department of Agriculture.

†Tests conducted in cooperation with H. O. Hill, superintendent.

Table 13. Yields of fall-sown oat varieties grown in replicated nursery plots, 1936-1941, inclusive, at Texas Substation No. 5, Temple, Texas

Number		Variety or strain	Yield of grain—bushels per acre						Average	
C. I.	T. S.		1936	1937	1938	1939	1940	1941	For years grown	Standard varieties same period
2382	9235	Nortex*	64.5	69.0	59.4	56.3	36.0	33.7	53.2	52.1
2766	20456	Alber*	69.9	66.4	48.7	50.6	27.8	34.6	49.7	52.1
2861	.....	Country Common*	83.2	61.8	51.4	51.7	33.8	38.7	53.4	52.1
		Total	217.6	197.2	159.5	158.6	97.6	107.0	156.3	.....
		Average	72.5	65.7	53.2	52.9	32.5	35.7	52.1	52.1
3422	26155	New Nortex	.....	.....	.....	67.6	39.0	36.6	47.7	40.4
3417	27871	Ranger	.....	58.3	66.3	53.6	29.3	37.4	49.0	48.0
3754	27908	Rustler	33.0	58.3	68.2	53.1	26.2	32.7	45.2	52.1
.....	.....	Nortex x Victoria, M19-2	92.8	59.0	52.4	48.0	22.8	39.5	52.4	52.1
.....	.....	Nortex x Victoria, M19-7	.....	64.6	74.4	53.4	34.0	35.2	52.3	48.0
.....	.....	Nortex x Victoria, M19-7-2	.....	.....	.....	.....	26.3	38.5	32.4	34.1
.....	.....	Nortex x Victoria, M19-8	45.6	62.6	60.0	54.1	25.0	35.4	47.1	52.1
.....	.....	Nortex x Victoria, M19-8-2	.....	.....	.....	.....	29.9	30.9	30.4	34.1
.....	.....	Nortex x Victoria, M19-17-1	.....	.....	.....	.....	31.4	36.8	34.1	34.1
.....	.....	Nortex x Victoria, M19-19-1	.....	.....	.....	.....	29.2	29.6	29.4	34.1
.....	.....	Nortex x Victoria, M19-29	.....	62.9	51.3	46.3	29.4	39.5	45.9	48.0
.....	.....	Nortex x Victoria, M19-29-1	.....	.....	.....	.....	31.2	32.3	31.8	34.1
.....	.....	Nortex x Victoria, M19-34	.....	69.7	63.0	53.6	31.9	38.4	51.3	48.0
.....	.....	Nortex x Victoria, M19-35	57.8	71.5	58.6	51.0	26.8	39.4	50.8	52.1
.....	.....	Nortex x Victoria, M19-38	.....	57.3	62.2	55.1	30.1	37.6	48.5	48.0
.....	.....	Nortex x Victoria, M19-56	.....	64.7	66.0	58.3	35.4	34.6	51.8	48.0
3534	.....	Nortex x Victoria, 11-34-103	.....	.....	.....	62.0	23.6	36.7	40.8	40.4
.....	.....	Nortex x Victoria, 11-35-8	.....	.....	.....	.....	28.0	40.5	34.2	34.1
3535	.....	Nortex x Victoria, 11-35-41	.....	.....	.....	.....	31.0	34.0	32.5	34.1
.....	.....	Nortex xVictoria, 11-35-58	.....	.....	.....	.....	27.6	35.0	31.3	34.1
.....	.....	Nortex x Victoria, 11-36-134	.....	.....	.....	.....	21.6	32.2	26.9	34.1
2401	18562	Victoria	2.4	41.8	43.7	59.4	22.2	34.8	34.0	52.1
2733	20451	Bond	23.2	.....	53.6	47.0	25.0	29.8	35.7	49.3
.....	.....	Ferguson x Alber, M4-5	.....	50.2	52.4	38.8	28.6	32.8	40.6	48.0
.....	.....	Nortex x Berger	.....	52.8	49.1	39.2	34.4	33.8	41.9	48.0
.....	.....	Nortex x Alber, M10-11	.....	52.3	54.2	54.3	27.2	31.4	43.9	48.0
.....	.....	Lee x Victoria, Ark. X2-25	.....	74.5	58.4	48.2	21.4	36.4	47.8	48.0
3531	28889	Fultex	.....	.....	.....	49.7	26.2	28.8	34.9	40.4
3528	.....	Fulghum x Victoria, 12-33-90	.....	.....	52.6	53.0	22.8	31.4	40.0	43.5
3529	.....	Fulghum x Victoria, 12-34-13	.....	.....	.....	48.6	27.4	35.0	37.0	40.4
3533	.....	Kanota x Victoria, 13-33-70	.....	.....	71.0	52.2	35.3	30.8	47.3	43.5
.....	.....	Kanota x Victoria, 13-34-12	.....	.....	.....	.....	31.2	35.6	33.4	34.1
.....	.....	Kanota x Victoria, 13-34-13	.....	.....	.....	.....	27.8	35.4	31.6	34.1
.....	.....	Appler & Bond, 15-34-63	.....	.....	.....	.....	30.9	35.6	33.2	34.1
3692	.....	Victorgrain	.....	.....	.....	.....	.....	33.8	33.8	35.7
3855	.....	Stanton Strain 1	.....	.....	.....	.....	.....	26.6	26.6	35.7

*Standard varieties, mean of which is used for comparison with varieties grown for shorter periods.

From 1936 to 1941, oat variety tests from fall-seeding were conducted in replicated rod-row nursery plots. The varieties, Nortex, Alber and Country Common, are used as standard varieties for comparison with hybrid strains. Country Common and Nortex produced the highest yields for the 7-year period. Nortex has a high average yield due largely to its exceptionally high yield in 1936. Among the varieties grown during the 5-year period, 1937 to 1941, several selections from the cross Nortex x Victoria (including the named variety, Ranger) gave average yields slightly above the average of the standard varieties.

Several varieties that were grown for only 3 years gave average yields above the standard varieties. New Nortex gave a 3-year average yield of 61.5 bushels per acre, which was 7.3 bushels above the average of the standard varieties.

It appears from these tests that none of the new varieties having the high resistance to crown rust derived from Victoria or Bond is superior in yielding ability in the Temple area to the commonly grown strains of the Texas Red type such as Nortex and New Nortex, which have only a moderate degree of resistance to crown rust.

Variety Trials at College Station

The Main Station Farm is located in the post oak strip of South-central Texas in Brazos County, one-half mile west of College Station. The mean annual precipitation is 38.8 inches The principal cultivated crops in the area are cotton, corn and truck crops. The upland soils represented by the station are sandy, poorly drained and of low fertility, and consequently poorly adapted to small grain production, although fair yields of rust-resistant varieties may be obtained through the use of liberal amounts of commercial fertilizers.

From 1936 to 1941, oat variety tests from fall-seeding were conducted in replicated rod-row nursery plots. Among the 15 varieties grown for the full 6-year period, the highest average yield was made by Ranger, a selection from a cross between Nortex and Victoria. The average yield of Ranger was 49.7 bushels per acre, or 9 bushels above its Nortex parent. In more recent years, several strains included in the tests for shorter periods have slightly outyielded the standard varieties, but few are outstanding.

Table 14. Yields of fall-sown oat varieties grown in replicated nursery plots at Main Station Farm, College Station, Texas, 1936-1941, inclusive

Number		Variety or strain	Yield of grain—bushels per acre						Average	
C. I.	T. S.		1936	1937	*1938	1939	1940	1941	For years grown	Standard varieties same period
3417	27871	Ranger*	59.2	41.5	56.9	28.8	46.1	55.8	49.7	44.5
3754	27908	Rustler*	66.7	24.7	46.2	28.2	36.3	63.4	44.2	44.5
2382	9235	Nortex*	47.2	33.6	40.8	29.3	34.1	59.4	40.7	44.5
2766	20456	Alber*	45.8	32.9	49.9	29.1	41.0	61.8	43.4	44.5
		Total	228.9	132.7	193.8	115.4	157.5	240.4		
		Average	57.2	33.2	48.4	28.8	39.4	60.1	44.5	44.5
2733	20451	Bond	39.2	39.8	55.7	33.0	31.8	64.9	44.1	44.5
2401	18562	Victoria	.....	32.8	54.2	33.2	25.8	53.0	39.8	42.0
2861	.....	Country Common	.....	35.8	50.4	29.8	29.4	69.6	43.0	42.0
3422	26155	New Nortex	.....	.....	.....	30.7	38.4	56.7	41.9	42.8
.....	.....	Nortex x Victoria, M19-2	45.1	33.0	52.6	28.9	40.1	73.6	45.6	44.5
.....	.....	Nortex x Victoria, M19-7	34.1	33.7	49.8	29.4	44.4	71.4	43.8	44.5
.....	.....	Nortex x Victoria, M19-7-2	.....	.....	.....	.....	37.4	67.4	52.4	49.7
.....	.....	Nortex x Victoria, M19-8	54.2	32.3	60.1	24.0	29.6	68.1	44.7	44.5
.....	.....	Nortex x Victoria, M19-8-2	.....	.....	.....	.....	36.1	57.4	46.8	49.7
.....	.....	Nortex x Victoria, M19-17-1	.....	.....	.....	.....	37.0	66.1	51.6	49.7
.....	.....	Nortex x Victoria, M19-19-1	.....	.....	.....	.....	32.0	57.0	44.5	49.7
.....	.....	Nortex x Victoria, M19-29	51.5	28.4	46.9	28.4	38.2	62.3	42.6	44.5
.....	.....	Nortex x Victoria, M19-29-1	.....	.....	.....	.....	44.5	63.7	54.1	49.7
.....	.....	Nortex x Victoria, M19-34	44.2	30.2	52.1	31.6	36.9	53.4	41.4	44.5
.....	.....	Nortex x Victoria, M19-35	37.3	28.0	59.6	29.4	37.6	66.4	43.0	44.5
.....	.....	Nortex x Victoria, M19-38	46.8	32.2	43.4	26.8	42.4	62.9	42.4	44.5
.....	.....	Nortex x Victoria, M19-46	35.7	31.5	52.8	29.2	43.8	61.4	42.4	44.5
3534	.....	Nortex x Victoria, 11-34-103	.....	.....	.....	30.8	36.6	62.4	43.3	42.8
.....	.....	Nortex x Victoria, 11-35-8	.....	.....	.....	.....	39.0	51.6	45.3	49.7
3535	.....	Nortex x Victoria, 11-35-41	.....	.....	.....	.....	32.4	59.8	46.1	49.7
.....	.....	Nortex x Victoria, 11-35-58	.....	.....	.....	.....	38.2	70.2	54.2	49.7
.....	.....	Nortex x Victoria, 11-36-134	.....	.....	.....	.....	35.3	57.0	46.2	49.7
.....	.....	Nortex x Alber, M10-11	60.0	34.6	59.6	32.2	35.1	57.9	46.6	44.5
.....	.....	Nortex x Berger, M5-3	54.1	33.8	59.2	29.0	36.9	59.8	45.5	44.5
.....	.....	Ferguson x Alber, M4-5	53.5	35.5	66.2	29.8	29.2	69.7	47.3	44.5
.....	.....	Appler x Bond, 15-34-63	.....	.....	.....	.....	44.4	64.4	54.4	49.7
3855	.....	Stanton (Coker 40-5)	.....	.....	.....	.....	.....	42.2	42.2	60.1
.....	.....	Lee x Victoria, Ark. x 2-25	.....	.....	41.1	30.2	41.4	67.4	45.0	44.2
3692	.....	Victorgrain	.....	.....	.....	.....	.....	59.0	59.0	60.1
3531	28889	Fultex	.....	.....	.....	33.4	31.5	63.0	42.6	42.8
3528	.....	Fulghum x Victoria, 12-33-90	.....	37.3	40.6	36.8	29.2	57.6	40.3	42.0
3529	.....	Fulghum x Victoria, 12-34-13	.....	.....	.....	34.2	41.7	74.2	50.0	42.8
3533	.....	Kanota x Victoria, 13-33-70	.....	40.1	50.6	30.8	31.6	50.2	40.7	42.0
.....	.....	Kanota x Victoria, 13-34-12	.....	.....	.....	.....	36.0	52.8	44.4	49.7
.....	.....	Kanota x Victoria, 13-34-13	.....	.....	.....	.....	39.3	47.0	43.2	49.7

*Standard varieties, mean of which is used for comparison with other varieties grown for shorter periods.

Variety Trials at Beeville*

The Beeville station is located in the Rio Grande Plains area 5.5 miles northeast of Beeville. The annual average precipitation is 30.7 inches. The principal crops are cotton, corn, grain sorghums, broomcorn and vegetables. Extensive areas are devoted to ranching.

From 1936 to 1941, oat variety tests were conducted in rod-row nursery plots. In 1936 and 1937, the varieties were grown in single unguarded rod-rows, and because of border effects and differential injury by birds and rodents, reliable yield comparisons were not obtained. These tests gave indications, however, that some of the new crown rust-resistant varieties had considerable promise for both grain production and winter pasture. From 1938 to 1941, replicated nurseries consisting of 44 varieties were grown. The nursery was severely injured by a spring drouth in 1938. This was followed by a severe epidemic of stem rust which completely destroyed all varieties that had survived the drouth. The nurseries grown in 1939 and 1940 were also destroyed by the great drouths of those years that extended over the greater part of Southwestern Texas. Conditions were closer to normal in 1941, and in that year many of the new crown rust-resistant selections gave excellent yields in comparison with the old Red Rustproof types. Yields of the 44 varieties grown in replicated nursery plantings in 1941 are given in Table 15. Satisfactory yields were produced by Ranger, Rustler and Fultex. Since 1942, the Rustler and Ranger varieties have been grown commercially with fair success in the Beeville area.

Variety Trials at Angleton†

The Angleton station is located on the Coastal Prairie 3 miles northeast of Angleton. The annual average precipitation is 46.5 inches. The principal crops grown in the area are rice, cotton and corn. Extensive areas are devoted to ranching.

From 1938 to 1940, oat varietal tests were conducted in replicated rod-row nursery plots. The strains included in the nursery consisted of crown rust-resistant selections of crosses with Victoria and Bond grown in comparison with parental and commercial varieties. The varieties Nortex, Ranger and Rustler are used as standard varieties for comparison with new strains in Table 15. The same strains were grown at Beeville in 1941 and data are included in the same table.

*Tests conducted in cooperation with R. A. Hall, superintendent.

†Tests conducted in cooperation with R. H. Stansel, formerly superintendent.

Table 15. Yields of fall-sown oats at Texas Substation No. 3, Angleton, Texas, 1938-1940, inclusive; and at Texas Substation No. 1, Beeville, Texas, in 1941

Number		Variety or strain	Angleton, Texas			Average for years grown	Average of standard varieties same years	Beeville
			Yield per acre—bushels					
C. I.	T. S.		1938	1939	1940			1941
2382	9235	Nortex*	10.4	44.2	41.4	32.0	33.3	3.1
2766	20456	Alber*	8.2	52.8	33.8	31.6	33.3	5.0
3417	27871	Ranger*	11.9	53.3	37.4	34.2	33.3	27.2
3754	27908	Rustler*	14.1	60.8	30.9	35.3	33.3	28.8
		Total	44.6	211.1	143.5	.....	.....	64.1
		Average	11.2	52.8	35.9	33.3	33.3	16.0
2733	20451	Bond	18.3	58.0	33.2	36.5	33.3	15.4
2401	18562	Victoria	14.3	49.7	22.0	28.7	33.3	27.4
2861	.....	Country Common	13.1	44.8	32.0	30.0	33.3	5.4
3422	26155	New Nortex	.....	41.0	28.0	34.7	44.3	4.0
.....	.....	Nortex x Victa. M19-2	11.9	62.6	32.8	35.8	33.3	26.7
.....	.....	Nortex x Victa. M19-7	15.1	58.1	42.4	38.8	33.3	24.6
.....	.....	Nortex x Victa. M19-7-2	.....	.....	37.4	37.4	35.9	27.1
.....	.....	Nortex x Victa. M19-8	13.3	59.0	35.6	36.0	33.3	31.8
.....	.....	Nortex x Victa. M19-8-2	.....	.....	39.5	39.5	35.9	28.4
.....	.....	Nortex x Victa. M19-17-1	.....	.....	37.1	37.1	35.9	28.4
.....	.....	Nortex x Victa. M18-18-1	.....	.....	38.5	38.5	35.9	29.8
.....	.....	Nortex x Victa. M19-29	11.9	64.2	33.6	36.6	33.3	22.8
.....	.....	Nortex x Victa. M19-29-1	.....	.....	33.9	33.9	35.9	30.8
.....	.....	Nortex x Victa. M19-34	8.8	56.8	35.4	33.7	33.3	27.9
.....	.....	Nortex x Victa. M19-35	14.6	60.3	35.8	36.9	33.3	29.6
.....	.....	Nortex x Victa. M19-38	13.5	62.4	37.6	37.8	33.3	28.9
.....	.....	Nortex x Victa. M19-46	12.9	51.9	37.7	34.2	33.3	26.9
3534	.....	Nortex x Victa. 11-34-103	.....	55.6	34.0	44.8	44.3	26.8
3535	.....	Nortex x Victa. 11-35-41	.....	.....	33.0	33.0	35.9	27.2
.....	.....	Nortex x Victa. 11-35-8	.....	.....	40.0	40.0	35.9	28.2
.....	.....	Nortex x Alber, M9-10	18.2	49.8	32.4	33.5	33.3	.....
.....	.....	Nortex x Alber, M10-11	15.9	52.4	35.2	34.5	33.3	18.8
.....	.....	Nortex x Berger, M5-3	12.4	36.8	31.8	27.0	33.3	13.0
.....	.....	Ferguson x Alber, M4-5	18.2	47.0	35.6	33.6	33.3	21.7
.....	.....	Appler x Bond, 15-34-63	.....	.....	39.9	39.9	35.9	24.4
.....	.....	Lee x Victa. Ark. x 2-25	5.0	48.4	37.8	30.4	33.3	25.4
3855	.....	Stanton (Coker 40-5)	.....	.....	.....	.....	.....	16.8
3531	28889	Fultex	.....	48.2	22.5	35.4	44.3	26.2
2528	.....	Fulghum x Victoria, 12-33-90	20.0	53.0	29.4	34.1	33.3	15.4
3529	.....	Fulghum x Victoria, 12-34-13	.....	48.7	23.2	35.5	44.3	21.6
3533	.....	Kanota x Victoria, 13-33-70	15.4	55.8	37.6	36.3	33.3	5.8
.....	.....	Kanota x Victoria, 13-34-12	.....	.....	38.0	38.0	35.9	25.0
.....	.....	Kanota x Victoria, 13-34-13	.....	.....	35.8	35.8	35.9	24.3
3692	.....	Victorgrain*	.....	.....	.....	.....	.....	23.4

*Standard varieties, mean of which is used for comparison with varieties grown for shorter periods.

Rust is less serious in the Angleton area than farther west in the State. Consequently, the commercial red oat varieties have given fair yields. However, many of the new hybrid strains, particularly Fultex and the Nortex x Victoria selections, have given higher average yields than any of the Red Rustproof types. The Ranger and Rustler varieties, and to a smaller extent Fultex and Victorgrain, have rapidly expanded commercial oat production. However, these varieties have recently been found to be very susceptible to Helminthosporium blight in this area, especially when grown on poorly drained soils. Where trouble is experienced with this disease, the Alber and Camellia may give better results, although Alber is less resistant to crown rust than the Victoria and Bond hybrid strains.

Variety Trials at Weslaco*

The Weslaco station is located in the Lower Rio Grande Valley about 3 miles east of Weslaco. The average annual precipitation is 24 inches, but only 6.94 inches of this amount falls during the small grain growing season of November to March, inclusive. Consequently, it is necessary to irrigate small grains occasionally during the growing season. The principal crops grown are citrus, vegetables and cotton.

Observation oat nurseries consisting of single rod-row plots were grown at Weslaco in 1940, 1941 and 1942, none of which gave reliable yield comparisons. The nursery was completely destroyed by storms in 1941, and birds injured some of the varieties in 1940 and 1942. Strains included in the test were from compound crosses with

Table 16. Yields of fall-sown oat varieties grown in single rod-row nursery plots at Texas Substation No. 15 at Weslaco in 1940 to 1942, inclusive

Variety	Yield of grain—bushels per acre			
	1940	1941 (a)	1942	1940-42 average
Ranger			31.7	
New Nortex	(d) 0.0		5.8	2.9
X35CL-2-1	49.6		35.8	42.7
X35CL-2-3	69.3		36.1	52.7
1415-8 x 5542-1 x 34BP-4-25-23	75.9		32.8	54.4
1415-8 x 5542-1 x 34BP-4-25-71	(c)		(b) 6.6	
1415-8 x 5542-1 x 34BP-2-30-4	(b) 17.1		39.1	28.1
1415-8 x 5542-1 x 34BP-2-30-20	(c)		51.5	
5542-1 x 1415-8 x 34BQ-3-24-5	(b) 20.0		(b) 20.7	
5542-1 x 1415-8 x 34BQ-3-24-19	(c)		27.3	
5542-1 x 1415-8 x 34BQ-3-36-6	98.5		49.5	74.0

(a) Destroyed by storms.
(b) Injured by birds.
(c) Destroyed by birds.
(d) Destroyed by rust.

*Tests at Weslaco made in cooperation with W. H. Friend, superintendent.

Red Rustproof, all being resistant to crown rust and to some races of stem rust. New Nortex and Ranger were included as standards for comparison.

Although no satisfactory yield data were obtained, observations and limited data indicate clearly that rust-susceptible varieties, such as New Nortex, are not dependable for grain production in that area. Ranger gave a yield of 31.7 bushels per acre in 1942, which would not be profitable under irrigation. Several early-maturing selections from crosses on Red Rustproof gave satisfactory yields in 1940 and 1942. Selection 3-36-6 from Victoria-Richland x Red Rustproof[2] produced a 2-year average yield of 74 bushels per acre. Before bird injury, several other strains appeared even more promising. Selection 32-24-5 from the same cross has proved especially adapted for the production of hay, pasture and dehydrated cereal leafmeal, and was released under the name Verde. Under commercial production, it was seriously damaged in 1945 by Helminthosporium blight and in certain other seasons by race 8 and 10 of stem rust.

Summary

Oats rank fifth in acreage among the farm crops of Texas, being exceeded by cotton, corn, wheat and grain sorghums in the order named. In the Central Texas Blackland area where the crop is best adapted, oats rank second only to cotton in acreage and value of the crop. The acreage and production in the western part of the State varies greatly, depending upon spring moisture conditions. The acreage of oats in South Texas has increased and will continue to increase as ample seed supplies of new rust-resistant varieties become available. In Central Texas, nearly all oats are fall-sown in the southern part of the area; and more than half are fall-sown in the northern part of this area. In the Rolling Plains area a large proportion are fall-sown, the remainder spring-sown; while in the High Plains area nearly all oats are spring-sown.

The yields of oats in pounds and in feeding value per acre are equal or superior to other grain crops in Central Texas. In the western part of the State, where precipitation is lower, oats yield less than grain sorghum, barley or wheat. In addition to grain production, oats provide a valuable winter pasture crop for much of the State; and provide a winter cover on land to prevent soil erosion. Practically all oats produced in Texas are utilized as feed for livestock within the State. As a grain feed for breeding stock, oats are unsurpassed. As a pasture crop, oats are the most palatable of the small grains and this green forage contains from 25 to 30 percent protein (dry basis).

Oats fit into the rotation in a manner similar to other small grains. In Central Texas, oats follow corn or cotton in the rotation most often as these crops provide satisfactory seedbeds. A common and inexpensive seedbed is that of drilling in the cotton stalks after only a light cultivation with a disc harrow or spring-tooth cultivator to level the ground. In West Texas, oats may follow nearly any crop since oats are spring-sown only in favorable seasons. In Central Texas, oats may be fall-sown from September to November, depending upon weather conditions and the needs of the growers for pasture. Optimum seeding dates are October 15 for fall-seeding and January 15 for spring-seeding. In South Texas, fall-seedings may be made somewhat later. In the Rolling Plains area, fall-seedings should be made between September 15 and October 15 for grain production, and spring-seedings before March 1. Fall-sown oats are hazardous in the High Plains area. If such plantings are made, they should be made by October 1, so that the crop may become well established before winter. Spring-seedings may be made from February 15 to March 15 as favorable conditions develop.

Oats may be harvested with a binder or with a combine harvester-thresher. They are less well-suited to direct combining than the other small grains as the straw usually breaks over soon after maturity. The use of strong-strawed varieties, such as Fultex, is of advantage for direct combining. Windrowing the crop followed by use of the combine with a pick-up attachment a few days later has been satisfactory under some conditions, especially when the oats are weedy. Oat straw has considerable feeding value, so many farmers prefer to harvest the crop with a binder before the grain is dead ripe in order to utilize the straw more advantageously.

Varieties of oats grown commercially in Texas are described in the text. Detailed data on yields of varieties and strains at the experiment stations at Denton, Greenville, Iowa Park, Chillicothe, Amarillo, Temple, Beeville, Angleton, Weslaco and College Station, Texas, are presented. A map showing the important oat-growing areas in the State and the location of the experiment stations is given. All varieties of oats now grown in the State belong to the red oat (*Avena byzantina*) group, being selections from or resulting from hybrids with the early-maturing Fulghum type, the Fulghum (winter type), or the Red Rustproof type.

Varieties recommended for growing in the main oat belt of Central Texas (Regions 3 and 4) are New Nortex, Ferguson No. 922 and Fultex. Stanton and Victorgrain also may be used satisfactorily on the basis of present tests. In the southern part of the State,

south of the Temple area, only rust-resistant varieties should be grown. These include the varieties Ranger, Rustler, Fultex, Victorgrain, Alber, Camellia and Verde. For special grazing purposes, further tests may prove that the white Northern or Corn Belt rust-resistant varieties may be valuable. For fall-seeding in the extreme northern part of Region 2, the Rolling Plains area, the very hardy varieties Wintok, Tennex and Fulwin may be used. Fultex, New Nortex and Ferguson 922 are well-adapted throughout Region 2 and may be used for spring-seeding. Fulghum strains may be used for spring-seeding. In the High Plains area, Region 1, only the most hardy varieties, such as Wintok, Fulwin and Tennex, should be used by those growers willing to risk fall-seeding. The Fulghum strains, Kanota and Frazier, and the varieties Fulton, Fultex or New Nortex may be used successfully in favorable spring seasons.

The principal diseases of oats in Texas are crown (leaf) rust, stem rust, smut and Helminthosporium blight. Careful grading of the seed to be sown will insure more uniform stands and stronger seedlings. Seed treatment is an efficient and inexpensive insurance against serious losses from smut and will aid in the control of Helminthosporium blight and seedling diseases. Methods of seed treatment are given in the text. Crown and stem rusts can be effectively controlled only by the growing of resistant varieties. The improved varieties, Fultex, Ranger, Rustler, Victorgrain, Stanton and Verde, are resistant to crown rust but susceptible to stem rust and to Helminthosporium blight. Verde is also resistant to some races of stem rust.

Extensive breeding work to develop additional new varieties resistant to these disease hazards is in progress.